

SCHOOL OF CIVIL ENGINEERING



# JOINT HIGHWAY RESEARCH PROJECT

JHRP-75-27

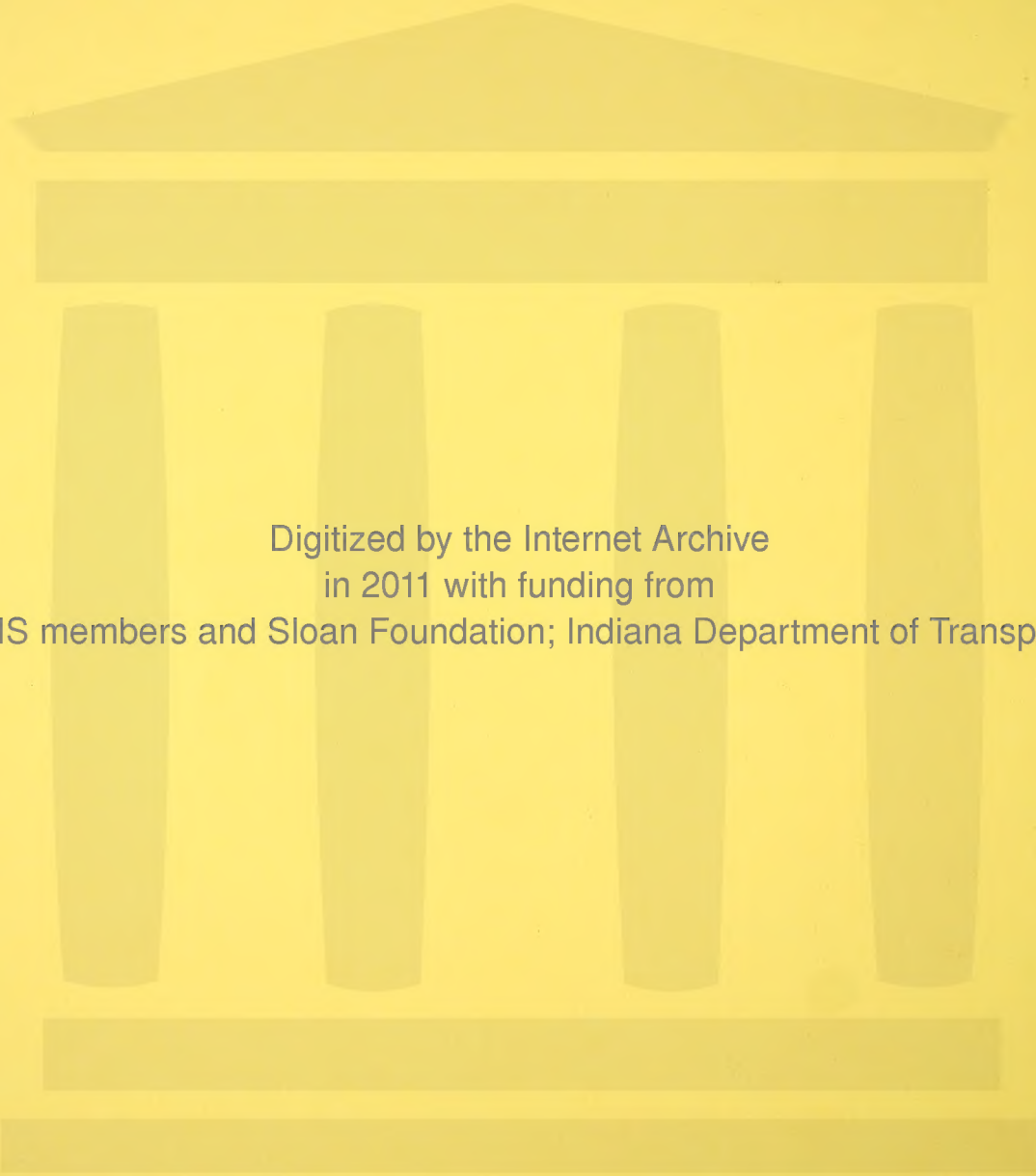
HISTORY OF THE INTERSTATE  
SYSTEM IN INDIANA

VOLUME II - EVOLUTION OF  
POLICIES AND STANDARDS

David A. Ripple



PURDUE UNIVERSITY  
INDIANA STATE HIGHWAY COMMISSION



Digitized by the Internet Archive  
in 2011 with funding from  
LYRASIS members and Sloan Foundation; Indiana Department of Transportation



## Final Report

### HISTORY OF THE INTERSTATE SYSTEM IN INDIANA

TO: J. F. McLaughlin, Director  
Joint Highway Research Project  
December 1, 1975  
Project: C-36-64H

FROM: H. L. Michael, Associate Director  
Joint Highway Research Project  
File: 3-5-8

Attached is the Final Report titled "History of the Interstate System in Indiana", authored by David A. Ripple a Graduate Instructor on our staff while conducting the research and authoring the Report. Professor W. L. Grecco, formerly of our staff, directed the study during its initial year and Professor Michael supervised it during the latter years and handled the lengthy review process. The Report has been reviewed by several personnel of the ISHC, including Mr. Walter Frick, and changes suggested by them have generally been made and are sincerely appreciated.

The History covers the period from the late 1930's through 1972. The Interstate System was not yet complete in 1972 and the period after 1972 is not reported herein. Perhaps it will be at a later date after the System is completed.

The Report is voluminous and therefore is issued in four (4) volumes as follows:

- Volume I - Development of the National Program  
(Chapters I thru IV)
- Volume II - Evolution of Policies and Standards  
(Chapter V)
- Volume III - Route History  
(Chapter VI)
- Volume IV - Cost, Funding and General Benefits  
(Chapters VII and VIII)

Another volume as an Appendix which is a detailed Table titled "Interstate Highway Construction Record" is also in preparation and will be issued at a later date. A brief summary of the entire history is also in preparation.





Each of the Volumes covers a part of the History and may be used separately as each is complete for the topic or topics covered. The entire set of four volumes provides an excellent in-depth reference document of the Interstate System history in Indiana and should be extremely valuable for many purposes. To my knowledge Indiana is the first state to prepare such a factual detailed history of the Interstate System.

Sincerely,

*Harold L. Michael*

Harold L. Michael  
Associate Director

HLM:ms

cc:	W. L. Dolch	M. L. Hayes	C. F. Scholer
	R. L. Eskew	G. A. Leonards	M. B. Scott
	G. D. Gibson	C. W. Lovell	K. C. Sinha
	W. H. Goetz	R. F. Marsh	L. E. Wood
	M. J. Gutzwiller	R. D. Miles	E. J. Yoder
	G. K. Hallock	P. L. Owens	S. R. Yoder
	D. E. Hancher	G. T. Satterly	





Final Report  
HISTORY OF THE INTERSTATE HIGHWAY SYSTEM IN INDIANA  
Volume II (Chapter V)  
EVOLUTION OF POLICIES AND STANDARDS

by

David Alan Ripple  
Graduate Instructor in Research

Joint Highway Research Project

Project No.: C-36-64H

File No.: 3-5-8

Joint Highway Research Project  
Engineering Experiment Station  
Purdue University

In Cooperation With

Indiana State Highway Commission

The contents of this Report reflect the views of the author who is responsible for the facts and the accuracy of the data presented herein. The contents do not necessarily reflect the official views or policies of the Indiana State Highway Commission or of the Joint Highway Research Project of Purdue University.

Purdue University  
West Lafayette, Indiana  
December, 1975





This dissertation is dedicated to those who conceived an interregional system of superhighways and to those who brought this concept into reality.





## ACKNOWLEDGEMENTS

With a deep sense of gratitude, the author wishes to personally thank Dr. William L. Grecco, Head of the Department of Civil Engineering at the University of Tennessee, for his counsel in developing the work program for this study and in implementing the first critical phases of the study. He has kindled my continued interest in urban and transportation planning and our association was an unforgettable intellectual experience.

The ultimate task of reviewing this report fell to Professor Harold L. Michael, Head of the Urban and Transportation Engineering Department at Purdue University, who succeeded Dr. Grecco as major professor. During the compiling of the report, his guidance and constructive criticism were invaluable.

The participation of Dr. Gilbert T. Satterly, Jr., of the Urban and Transportation Engineering Department, Dr. Harvey H. Marshall, Jr., of the Department of Sociology, and Dr. David H. Root of the Department of Statistics in the review and critique of this research was most welcome.

The open cooperation of the Indiana State Highway Commission personnel in providing access to their files, in compiling data for portions of the report and in supplying information in extensive interviews was responsible to a large degree for the success of the research. The cooperation of the Indiana Division Office of the Federal Highway Administration and many other transportation related agencies throughout Indiana in providing additional information was invaluable.





The author also owes a debt of gratitude to the secretaries of the Joint Highway Research Project office who typed this report, the draft persons who constructed the illustrations, and his fellow students who offered encouragement and support for this research.

Not least, I acknowledge the unrepayable debt to Melinda, my wife, for reviewing the rough drafts of this report as well as providing continual moral support.



## TABLE OF CONTENTS

	Page
LIST OF TABLES. . . . .	xvi
LIST OF FIGURES . . . . .	xix
ABSTRACT. . . . .	xxvii
CHAPTER I - INTRODUCTION. . . . .	1
CHAPTER II - THE NEED FOR AN INTERSTATE HIGHWAY SYSTEM AND INTERSTATE SYSTEM GOALS . . . . .	7
The Traditional Role of Transportation . . . . .	7
Early Governmental Involvement in Transportation. . . . .	9
Governmental Involvement in Highway Transportation on a Continuous Basis. . . . .	12
The Need Arises. . . . .	13
Goals. . . . .	14
Notes. . . . .	17
CHAPTER III - DEVELOPING A PROGRAM. . . . .	18
Toll Roads and Free Roads. . . . .	19
The Future of Indiana Roads. . . . .	23
Highway Needs for National Defense . . . . .	24
Planning the Interregional Highway System. . . . .	25
Interregional Highways . . . . .	27
Background for Study. . . . .	29
The Recommended Interregional Highway System . . . . .	31
Selection of Routes for the Inter- regional System. . . . .	35
Route Selection in Urban Areas. . . . .	40
Access Limitation . . . . .	41
Acquisition of Rights-of-Way. . . . .	42
Design of the Interregional System. . . . .	43
Constructing the Interregional System . . . . .	44
Financing the Interregional System. . . . .	45
Conclusion. . . . .	50





## TABLE OF CONTENTS (Continued)

	Page
The First Completion Cost Estimate. . . . .	51
Status of Interstate Improvement . . . . .	53
Correcting the Deficiencies. . . . .	56
Retrospect . . . . .	58
More Studies. . . . .	59
The National Highway Study . . . . .	59
DuPont's Informal Advisory Committee . . . . .	60
Needs of the Highways from 1955 to 1984 . . . . .	61
Highway Inadequacy . . . . .	62
Highway Improvement Estimate . . . . .	64
Construction Needs for the First Ten Years. . . . .	65
Construction Needs for the Next Twenty Years . . . . .	68
Construction Expenditure. . . . .	69
Maintenance and Administrative Needs and Expenditures . . . . .	71
Total Needs and Expenditures. . . . .	72
Highway Improvement Financing. . . . .	72
Conclusion . . . . .	75
The National Highway Program Study. . . . .	76
Program Recommendations. . . . .	78
Inadequacy of the Present Highway Network. . . . .	80
Cost of Modernization. . . . .	81
Financing the National Highway Program . . . . .	84
Implementation of the National Highway Program . . . . .	90
Report Conclusion. . . . .	91
Notes . . . . .	92
CHAPTER IV - THE PROGRAM AND ITS EVOLUTION . . . . .	94
Construction Time . . . . .	95
Manpower. . . . .	97
Material and Equipment. . . . .	98
Financing in General. . . . .	98
Federal Highway Trust Fund . . . . .	98
Highway Acts . . . . .	100
Apportionment of Funds. . . . .	101
Federal Share . . . . .	104
Use of Funds. . . . .	104
Interstate Use Restrictions . . . . .	105
Administrative Policy . . . . .	106
Right-of-Way Acquisition. . . . .	107
Inclusion of Toll Roads in the Interstate System. . . . .	108



## TABLE OF CONTENTS (Continued)

	Page
Reimbursement for Completed	
Interstate Sections. . . . .	109
Other Provisions. . . . .	110
Indiana Motor Vehicle Fund . . . . .	111
Notes . . . . .	113
CHAPTER V - EVOLUTION OF POLICIES AND STANDARDS. . . . .	114
Planning. . . . .	116
Criteria for Corridor Selection and	
Mileage Designation . . . . .	116
Route Location Procedure . . . . .	122
Location Criteria . . . . .	122
Indiana's Route Location Process. . . . .	127
Evolution of the Route Alternative	
Evaluation Process. . . . .	132
Criteria Used to Evaluate Alternatives. . . . .	132
Evaluation of Economic Analysis	
Techniques . . . . .	134
Evolution of the Decision-Making Process . . . . .	138
Overview of the Decision Making	
Process. . . . .	138
The Decision-Making Process in Indiana. . . . .	140
Evolution of the Review Process. . . . .	141
Public Participation and the Public	
Hearing Process. . . . .	144
Notice Offering Public Hearing . . . . .	147
Notice of Public Hearing . . . . .	149
Conduct of Hearing . . . . .	151
Action on Transcript . . . . .	154
Notice of Request for Approval . . . . .	155
Notice of Project Approval . . . . .	156
Other Changes in the Review Process . . . . .	157
A-95 Review - Project Notification	
and Review System. . . . .	161
Design. . . . .	167
Evolution of Design Standards. . . . .	167
Influence of Forerunners on	
Interstate Design. . . . .	174
Interstate Design Standards . . . . .	176
Change in the Design Year . . . . .	177
Minimum Four-Lane Requirement . . . . .	178
Evolution of Pavement Design. . . . .	179
Safety in Design. . . . .	183
Safety Provisions for Roadside	
Features and Appertenances. . . . .	184





## TABLE OF CONTENTS (Continued)

	Page
Evolution of the Interstate System Cross Section. . . . .	188
Evolution of Bridge Design . . . . .	196
Traffic Control and Protection Devices . . . . .	210
Considerations in Grade Treatment . . . . .	211
Evaluation of Design Alternatives . . . . .	213
Evolution of the Interchange . . . . .	214
Interchange Location and Spacing. . . . .	215
External Factors . . . . .	216
Internal Factors . . . . .	219
Special Considerations . . . . .	220
Interchange Justification. . . . .	224
Selection of Interchange Type . . . . .	227
Interchange Design and Special Considerations . . . . .	236
Other Design Features. . . . .	238
Evolution of the Separation . . . . .	238
Evolution of Road Closure . . . . .	241
Evolution of the Frontage Road. . . . .	242
Utilization of Collector-Distributor Roads. . . . .	243
✓ Federal and State Policy As It Affects Design. . . . .	244
Policies on Grade Separated Crossroads Without Ramps. . . . .	244
Policies on Interchanges. . . . .	255
Policies on Other Roads . . . . .	257
Policies on Additional Through Lane . . . . .	260
Policies on Safety Improvements. . . . .	262
Policy on Abandonment and Revision of Plans . . . . .	266
Federal Aid Financing on Completed Sections of the Interstate System. . . . .	268
Flexibility in Design . . . . .	269
The Role of Traffic Engineering in Interstate Design. . . . .	270
Other Functional Areas. . . . .	272
New Concepts . . . . .	272
Joint Development . . . . .	273
Multiple Use Development. . . . .	275
Environmental Emphasis. . . . .	277
The Environmental Impact Statement and the 4(f) Statement Processes . . . . .	283
Content of Environmental Impact Statement . . . . .	288



## TABLE OF CONTENTS (Continued)

	Page
The Environmental Impact	
Statement Process in	
Indiana . . . . .	293
Roadside Development . . . . .	294
Evolution of Landscape Design . . . . .	294
Landscaping and Scenic Enhancement. . . . .	296
Safety Rest Parks . . . . .	299
Scenic Overlooks. . . . .	302
Scenic Strips . . . . .	302
Control of Outdoor Advertising. . . . .	303
Control of Junkyards. . . . .	307
Land Acquisition . . . . .	308
Evolution of the Land Acquisition	
Process. . . . .	309
The Practice of Land Acquisition. . . . .	312
Access Control. . . . .	315
Advance Land Acquisition. . . . .	316
Overview of Advanced Land	
Acquisition . . . . .	317
Alternatives to Advanced Land	
Acquisition . . . . .	320
Excess Condemnation . . . . .	323
Relocation . . . . .	325
General Relocation Policies and	
Procedures . . . . .	326
Evolution of Relocation Process . . . . .	333
Compensation for Losses . . . . .	334
Losses Due to Direct Displacement. . . . .	335
Losses Due to Uncertainty or	
Delay . . . . .	340
Indirect Losses in Surrounding	
Areas . . . . .	341
Cooperation with Other Agencies . . . . .	342
Utilities Relocation . . . . .	342
Utility Relocation Procedures . . . . .	343
Utility Accommodation Policies. . . . .	345
Specifications, Contracts and Bidding. . . . .	347
Specifications. . . . .	349
Contract Proposal . . . . .	350
Notice to Contractors. . . . .	350
Special Provisions . . . . .	350
Federal Provisions . . . . .	351
Proposal . . . . .	352
Bid Schedule . . . . .	353
Bid Guarantee. . . . .	353
Contract . . . . .	354
Bond . . . . .	354





## TABLE OF CONTENTS (Continued)

	Page
Bidding . . . . .	354
Construction . . . . .	355
Construction Policies and Procedures.	355
Evolution of Construction Technology.	357
Maintenance. . . . .	358
Interstate System Construction Priorities . . .	360
Notes . . . . .	362
CHAPTER VI - ROUTE HISTORY . . . . .	371
Prelude . . . . .	372
Early Highway Acts . . . . .	372
Designation of Interstate Mileage. . . . .	375
A Time of Study and Little Construction. .	379
The Interstate Program . . . . .	382
Formulation of the Indiana Interstate System. . . . .	384
Indianapolis Metropolitan Area Interstates. . .	385
Background of the Indianapolis Interstates	387
Interstate Route 465 . . . . .	390
East Leg. . . . .	392
Relocation from Shadeland Avenue. . . . .	392
Comparison of the Revised Route with a Route Farther East .	394
Woolen's Gardens . . . . .	396
Fall Creek Road and Fall Creek Parkway . . . . .	399
Interchange of Interstate 465 and Interstate 70 . . . . .	400
North Leg . . . . .	401
Lochner Location Study . . . . .	402
Continued Opposition . . . . .	408
Design Changes . . . . .	411
West Leg. . . . .	413
South Leg . . . . .	414
Interchanges . . . . .	416
Lake Shore Golf Course . . . . .	417
Interstate Routes Inside Interstate 465. .	417
Location Studies. . . . .	418
Inner Belt . . . . .	418
West Route . . . . .	422
South Route. . . . .	427
East Route . . . . .	432
Northwest Route. . . . .	433
Additions and Alternatives to the Recommended Inner City Inter- state Freeway System . . . . .	436
North Freeway. . . . .	440
Northeast Freeway. . . . .	440
Modified Plan. . . . .	446



## TABLE OF CONTENTS (Continued)

	Page
Interstate Type West Leg for the Inner Belt. . . . .	449
Supplemental Freeways. . . . .	452
Design of the Inner City Interstate Freeway System . . . . .	459
Depressed Versus Elevated. . . . .	459
Inner Belt Design. . . . .	461
North Leg Inner Belt Design. . . . .	463
Northeast Inner Belt Master Interchange . . . . .	467
East Leg Inner Belt Design . . . . .	468
Southeast Inner Belt Master Interchange . . . . .	471
South Leg Inner Belt Design. . . . .	472
West Leg Inner Belt Design . . . . .	473
West Route Design. . . . .	473
South Route Design . . . . .	475
East Route Design. . . . .	476
Northwest Route Design . . . . .	478
Public Interest . . . . .	479
Public Hearings. . . . .	479
Continued Opposition . . . . .	485
Indianapolis Metropolitan Area Interstates Outside Interstate 465. . . . .	488
Southport Road Controversy. . . . .	488
Separation of 82nd and 86th Streets on Interstate 65 North . . . . .	494
86th Street Separation on Interstate 69 . . . . .	496
Bridgeport Road Separation on Interstate 70 West . . . . .	496
Interstate 70 East in Marion County . . . . .	497
Interstate 74 Interchange at Clermont . . . . .	498
Interstate Route 64 . . . . .	500
Shifting Corridors . . . . .	502
Original Location Proponents. . . . .	503
Southern Route Proponents . . . . .	504
Comparison of Route Alternatives. . . . .	505
Population Density . . . . .	505
Population and Economic Growth . . . . .	507
Service to Evansville and Crane Naval Depot . . . . .	507
User Benefits. . . . .	508
Construction Cost. . . . .	509
Resolution of Events. . . . .	509
Southern Route Location Studies . . . . .	511





## TABLE OF CONTENTS (Continued)

	Page
Lynville Location Study. . . . .	512
Alternative Location Study from	
SR 57 to SR 45 . . . . .	512
Alternatives in the SR 61 Inter-	
change Area. . . . .	516
Alternatives near Warrick County	
Road 600 West. . . . .	518
Location Alternatives Between State Road	
145 and State Road 64 . . . . .	518
Location of Interstate 64 in New Albany. .	521
Early Location Studies. . . . .	521
Reevaluation of the New Albany	
Location . . . . .	525
Additional Interchanges. . . . .	528
Interstate Route 65 . . . . .	529
Jeffersonville . . . . .	530
Interstate 65 Location Studies from	
Jeffersonville to Indianapolis. . . .	533
Alternatives from Jeffersonville to	
Seymour. . . . .	533
Alternatives from Seymour to	
Indianapolis . . . . .	534
Interstate 65 South: Special Requests . .	542
Market Street Exit Ramps. . . . .	542
Memphis Interchange . . . . .	547
Underwood Interchange . . . . .	548
Jackson County. . . . .	549
State Road 44 Interchange . . . . .	551
Interchange 65 Location Studies from	
Indianapolis to Gary. . . . .	553
Swanington to Gary Location Study . .	553
Lafayette . . . . .	554
Wildcat Creek Reservoir . . . . .	566
Interstate 65 North: Special Requests . .	571
Directional Sign to Whitestown. . . .	571
Tippecanoe County . . . . .	572
Clinton County. . . . .	574
Jasper County . . . . .	574
Indian Gardens. . . . .	575
Crownpoint Interchange. . . . .	578
Additional Service in Gary. . . . .	579
Interstate Route 69 . . . . .	582
Shift of Corridor: West of Anderson to	
East of Anderson. . . . .	582
Shift of Interstate 69 from a Junction	
with Interstate 70 to a Junction	
with Interstate 465 . . . . .	588



## TABLE OF CONTENTS (Continued)

	Page
Huntington and the Huntington Reservoir. . . . .	594
Fort Wayne Relocation. . . . .	598
Extension of Interstate 69 . . . . .	599
Special Cases Involving Access Treatment . . . . .	607
Allen County. . . . .	607
DeKalb County . . . . .	612
Delaware County . . . . .	615
Grant County. . . . .	615
Hamilton County . . . . .	616
Huntington County . . . . .	618
Steuben County. . . . .	619
Interstate Route 70 . . . . .	621
Interstate 70 East . . . . .	621
Richmond Bypass . . . . .	621
Location of Interstate 70 in Central Indiana. . . . .	623
Special Cases and Route Service . . . . .	627
Henry County . . . . .	629
Wayne County . . . . .	630
Interstate 70 West . . . . .	632
Terre Haute Bypass. . . . .	632
Strip Mining Conflicts. . . . .	636
Interstate 70 in Central Indiana. . . . .	639
Special Cases and Route Service . . . . .	639
Clay County. . . . .	639
Putnam County. . . . .	641
Vigo County. . . . .	644
Interstate Route 74 . . . . .	648
Interstate 74 East . . . . .	648
Location Studies. . . . .	648
Special Cases . . . . .	649
Dearborn County. . . . .	650
Decatur County . . . . .	650
Shelby County. . . . .	651
Interstate 74 West . . . . .	652
Location Studies. . . . .	652
Special Cases . . . . .	658
Hendricks County . . . . .	658
Fountain County. . . . .	659
Montgomery County. . . . .	662
Vermillion County. . . . .	664
Tri-State Highway . . . . .	664
Lake County. . . . .	667
Grand Boulevard Separation. . . . .	667
Central Avenue Interchange. . . . .	671
SR 51 Interchange . . . . .	671
Commitments by Gary . . . . .	672



## TABLE OF CONTENTS (Continued)

	Page
Porter County . . . . .	673
Bethlehem Steel . . . . .	673
Alternate Location South of Indiana Toll Road . . . . .	676
Samuelson Road Separation . . . . .	676
Separation Requests . . . . .	681
SR 149 Interchange Request . . . . .	684
Chesterton . . . . .	684
LaPorte County . . . . .	687
Wagner Road Interchange . . . . .	687
Grade Separation Requests . . . . .	689
Additional Traffic Lanes . . . . .	691
Indiana East-West Toll Road . . . . .	693
Historical Background . . . . .	693
Location Studies . . . . .	694
Status . . . . .	697
Interstate Route 265 . . . . .	697
Location Studies . . . . .	698
Route Service . . . . .	701
SR 111 Interchange . . . . .	701
Extension of Interstate 265 . . . . .	702
Louisville Transportation Study . . . . .	703
Interstate Route 275 . . . . .	703
Location Studies . . . . .	704
Route Service . . . . .	712
Interstate System Additions in 1968 . . . . .	712
Request for Additions . . . . .	714
Northeast Freeway in Indianapolis . . . . .	715
Interstate 63 . . . . .	716
Interstate 294 Extension . . . . .	718
Interstate 164 . . . . .	720
Interstate 465 West Leg Extension . . . . .	724
Notes . . . . .	725
CHAPTER VII - PROGRAM REVIEW . . . . .	732
Inter-Governmental Cooperation . . . . .	732
Construction Progress . . . . .	735
Early Years . . . . .	735
Urban Bypasses and Critical Gaps . . . . .	738
System Extension . . . . .	742
Completing the System . . . . .	748
Costs . . . . .	754
Interstate Cost Estimate Studies . . . . .	754
1958 Cost Estimate . . . . .	757
1961 Cost Estimate . . . . .	757
1965 Cost Estimate . . . . .	761
1968 Cost Estimate . . . . .	762
1970 Cost Estimate . . . . .	762
1972 Cost Estimate . . . . .	764
Additional Cost Estimate . . . . .	764





## TABLE OF CONTENTS (Continued)

	Page
Evolution of Costs . . . . .	765
Analysis of Increase from 1949 to 1955 . . . . .	765
Analysis of Increase from 1955 to 1958 . . . . .	768
Cost Analysis from 1958 to 1961 . . . . .	769
Analysis of Increase from 1961 to 1965 . . . . .	770
Analysis of Increase from 1965 to 1968 . . . . .	773
Analysis of Increase from 1968 to 1970 . . . . .	776
Analysis of Increase from 1970 to 1972 . . . . .	778
Future Increases in the Total Cost of the System. . . . .	781
Actual Costs . . . . .	782
Funding . . . . .	786
Authorizations and Apportionments. . . . .	786
Federal Highway Act of 1958 . . . . .	788
Federal Highway Act of 1959 . . . . .	788
Federal Highway Act of 1961 . . . . .	791
Federal Highway Act of 1965 . . . . .	792
Federal Highway Act of 1966 . . . . .	792
Federal Highway Act of 1968 . . . . .	792
Federal Highway Act of 1970 . . . . .	793
Future Legislation. . . . .	793
Utilization of Funds . . . . .	794
Interstate Work Load. . . . .	807
Notes . . . . .	812
CHAPTER VIII - GENERAL BENEFITS. . . . .	814
Benefits. . . . .	814
User Benefits. . . . .	815
Community Benefits . . . . .	816
Effect on Other Highway Programs. . . . .	825
The Second Time Around. . . . .	826
Notes . . . . .	830
BIBLIOGRAPHY . . . . .	831
General References. . . . .	831
Location Studies and Reports. . . . .	843
APPENDIX . . . . .	851



## LIST OF TABLES

<u>Table</u>		<u>Page</u>
1	Estimated Urban, Rural, and Total Mileage, Total Rural Vehicle Mileage and Average Daily Traffic on Rural Sections Studied, Including the Recommended System . . . . .	37
2	Classification of Public Highway Expenditures . . . . .	48
3	Inventory of Interstate Mileage Type of Payement and Class of Area . . . . .	55
4	Inventory of Interstate Mileage, Surface Width by Class of Area and Type of Facility . . . . .	55
5	1955-64 National Construction Needs. . . . .	66
6	1955-64 Indiana Construction Needs . . . . .	66
7	Proposed 10-Year National Highway Program Financing. . . . .	85
8	Financial Plan for Highway Program . . . . .	89
9	Interstate Cross Section Characteristics. .	191
10	Interchange and Separation Spacing . . . . .	223
11	Interchange Classification . . . . .	234
12	Interstate 275: Cost Comparison of Alternatives . . . . .	708
13	Interstate Mileage Designated. . . . .	758
14	Funds Required to Complete Interstate System . . . . .	759





## LIST OF TABLES (Continued)

<u>Table</u>		<u>Page</u>
15	Estimate of Cost of Completing the Interstate System in Indiana by Route. . . .	760
16	Estimated Total Cost of the Interstate System for Nation. . . . .	766
17	Estimated Total Cost of the Interstate System in Indiana. . . . .	767
18	Cost Analysis of Increase of Interstate Cost for Nation. . . . .	771
19	1965 Interstate Cost Estimate: Cost Analysis of Increase in Cost Over 1961 Estimate . . . . .	772
20	1968 Interstate Cost Estimate: Cost Analysis of Increase in Cost Over 1965 Estimate . . . . .	774
21	1970 Interstate Cost Estimate: Cost Analysis of Increase in Cost Over 1968 Estimate . . . . .	777
22	1972 Interstate Cost Estimate: Cost Analysis of Increase in Cost Over 1970 Estimate . . . . .	780
23	Expenditures in Indiana. . . . .	784
24	Costs of Indiana Interstate Routes . . . . .	785
25	Interstate Authorizations. . . . .	787
26	Status of Financing Federal Share of Cost to Complete the Interstate System. . . . .	789
27	Federal Aid Highway Apportionments for Nation . . . . .	795
28	Interstate Funds Apportioned to the Nation .	796
29	Interstate Funds Apportion to the State of Indiana by Law. . . . .	799
30	Federal Highway Program Financing in Indiana. . . . .	801



## LIST OF TABLES (Continued)

Table		Page
31	Status of Interstate Funds in Indiana. . .	804
32	Estimate of Funds Required to Complete the Interstate System Based on the 1972 Interstate Cost Estimate . . . . .	805
33	Estimate of Funds Required to Complete the Interstate System Based on the 1974 Interstate Cost Estimate . . . . .	805
34	Total Contracts Let and Awarded. . . . .	810
35	Average Number of Employees in the Indiana State Highway Commission . . . . .	811
36	Relocation Statistics for Interstate . . .	820
37	Analysis of Relocation Assistance and Payments for Interstate System in Indiana from October 1, 1965 to September 30, 1968 . . . . .	821
38	Analysis of Relocation Assistance for Interstate System in Indiana From October 1, 1968 to June 30, 1973 . . . . .	822
39	Analysis of Relocation Payments for Interstate System in Indiana From October 1, 1968 to June 30, 1973 . . . . .	822
40	Status of Improvement of Interstate Highways in Indiana. . . . .	851
41	Mileage Open to Traffic. . . . .	874
42	Summary of Interstate Route Mileage. . . .	892



## LIST OF FIGURES

<u>Figure</u>		<u>Page</u>
1	Major Highways in Indiana Prior to 1850. . . .	11
2	The Transcontinental Toll Road System. . . .	21
3	Location of Existing Routes Selected as Approximating the Lines of a Proposed Interregional Highway System . . . . .	22
4	The 29,300-Mile System Investigated by the Public Roads Administration as an Interregional System in June 1941. . . . .	26
5	The General Location of Routes of the Recommended Interregional Highway System . .	32
6	Relation of the Recommended Interregional System to the Strategic Network of May 15, 1941 . . . . .	34
7	Graph Employed in Refining Committee's Selection of the Interregional System. . . .	37
8	The 36,000-Mile Interregional System . . . .	39
9	Rate of Expenditure Based on National Construction Needs from 1954 to 1984 . . . .	70
10	Rate of Expenditure Based on National Construction, Maintenance and Administration Needs from 1954 to 1984. . . . .	73
11	Rate of Expenditure Based on Interstate Construction, Maintenance and Administrative Needs from 1954 to 1984 . . .	74
12	National System of Interstate Highways: Rural Status of Improvement by 1965. . . . .	83





## LIST OF FIGURES (Continued)

<u>Figure</u>		<u>Page</u>
13	Project Notification and Review System. . .	163
14	Design Process. . . . .	169
15	Federal Participation in Cost of Eliminating Pavement Deficiencies . . . . .	182
16	Typical Interstate Cross Sections in Indiana . . . . .	190
17	Horizontal Clearances - All Interstate Overcrossing Structures Except Major Long Span Structures. . . . .	199
18	Horizontal Clearances - Major Long Span Structures Interstate System Overcrossings.	200
19	Horizontal Clearances Major Span Structures in Indiana . . . . .	201
20	Horizontal Clearances - Auxiliary Lanes Interstate System Overcrossings . . . . .	203
21	Guardrail Placement . . . . .	205
22	Guardrail-Bridgerail Transition . . . . .	206
23	Roadside Clearance to Bridge Supports . . .	209
24	Interchange Type Selection Process. . . . .	228
25	Limit of Federal Participation. . . . .	246
26	Limit of Federal Participation. . . . .	247
27	Limit of Federal Participation. . . . .	247
28	Limit of Federal Participation. . . . .	248
29	Limit of Federal Participation. . . . .	248
30	Limit of Federal Participation. . . . .	249
31	Limit of Federal Participation. . . . .	249
32	Limit of Federal Participation for Cross- road Relocation . . . . .	251



## LIST OF FIGURES (Continued)

<u>Figure</u>		<u>Page</u>
33	Limit of Federal Participation for Crossroad Relocation. . . . .	251
34	Limit of Federal Participation. . . . .	252
35	Limit of Federal Participation from Interchange Ramps . . . . .	256
36	Federal Participation in Frontage Roads . .	258
37	Federal Participation in Frontage Roads . .	259
38	Environmental Impact Statement Process at the Location Stage. . . . .	287
39	Environmental Impact Statement Process at the Design Stage. . . . .	289
40	Safety Rest Parks . . . . .	300
41	National System of Interstate Highways Designated on August 2, 1947. . . . .	380
42	Proposed Interstate Routes in the Indianapolis Metropolitan Area in September of 1955 . . . . .	386
43	Interstate 465 - East Leg: Relocation from Shadeland Avenue . . . . .	395
44	Interstate 465 - East Leg: Comparison of Revised Location with Warren Civic Association Location. . . . .	397
45	Woolen's Gardens Area . . . . .	398
46	Interstate 465 - North Leg: Location Alternatives. . . . .	404
47	Interstate 465 - South Leg: Relocation of Southwest Corner . . . . .	415
48	General Corridors for Interstate Routes Inside Interstate 465 . . . . .	419
49	Interstate 70 - West Route: Original Location. . . . .	423





## LIST OF FIGURES (Continued)

<u>Figure</u>		<u>Page</u>
50	Alternative Locations for Interstate Routes Inside Interstate 465. . . . .	425
51	Interstate 70 - West Route: Revised Location and Alternatives . . . . .	426
52	Interstate 65 - South Route: Revised and State Avenue Locations. . . . .	430
53	Interstate 65 - South Route: Relocation and Alternatives. . . . .	431
54	Interstate 70 - East Route: Recommended Location. . . . .	434
55	Indianapolis Interstate Highway System Plan of 1957. . . . .	437
56	Indianapolis Interstate Highway System Plan of 1957 - Anticipated 1975 Traffic Volumes . . . . .	438
57	Final Location of the Indianapolis Interstate Freeways . . . . .	439
58	Central Business District Thoroughfare Plan of 1963. . . . .	441
59	Official Thoroughfare Plan for Marion County in 1962. . . . .	442
60	Recommended Central Business District Thoroughfare Plan in 1969 . . . . .	443
61	Recommended Thoroughfare Plan for 1985. . .	444
62	Proposed North Freeway and Northeast Freeway . . . . .	445
63	The Proposals fo Livable Indianapolis for Everyone and the Indianapolis Tax-payers Association. . . . .	448
64	Interstate Type West Leg for the Inner Belt Along the Proposed Harding Expressway. . . . .	451



## LIST OF FIGURES (Continued)

<u>Figure</u>		<u>Page</u>
65	Interstate Type West Leg for the Inner Belt Through the University Complex . . . . .	453
66	Supplemental Freeways for Central City: Alternative 1 - Route Through University Complex. . . . .	454
67	Supplemental Freeways for Central City: Alternative 2 - Modified Plan . . . . .	455
68	Supplemental Freeways for Central City: Alternative 3 - Proposed SR 37. . . . .	456
69	Supplemental Freeways for Central City: Alternative 4 - Proposed Interstate Freeway System. . . . .	457
70	Indianapolis Inner Belt Design in 1970. .	464
71	Interstate 70 - West Route: Alternative Locations Through Stout Field . . . . .	483
72	Interstate 65: Proposed Interchange Locations South of I-465 in Marion County. . . . .	489
73	Interstate 64: Economic Comparison of Route Alternatives . . . . .	506
74	Interstate 64: Alternative Locations in the Lynnville Area . . . . .	513
75	Interstate 64: Alternatives in the SR 61 Interchange Area and Near Warrick County Road 600 West . . . . .	517
76	Interstate 64 - Harrison County Planning Commission Alternative Location . . . . .	520
77	Interstate 64: The Three General Corridors for the Ohio River Crossing . .	522
78	Interstates 64 and 65: Alternative Ohio River Crossings. . . . .	526



## LIST OF FIGURES (Continued)

<u>Figure</u>		<u>Page</u>
79	Interstate 65: Alternatives from Seymour to Indianapolis . . . . .	535
80	Interstate 65: Jeffersonville. . . . .	544
81	Proposed Market Street Ramp . . . . .	545
82	Interstate 65: Jackson County. . . . .	550
83	Franklin Thoroughfare Plan. . . . .	552
84	Interstate 65: Swanington to Gary. . . . .	555
85	Interstate 65: From Lebanon to Fair Oaks. . . . .	558
86	Interstate 65: Location Alternatives and Proposed Future Land Use of Lafayette . .	560
87	Proposed Traffic Plan for Metropolitan Lafayette in 1961 . . . . .	561
88	Interstate 65: Alternative Locations in White and Jasper Counties. . . . .	564
89	Interstate 65: Alternative Locations in the Proposed Wildcat Reservoir Area. .	567
90	Interstate 65: Alternate Route Through Indian Gardens. . . . .	576
91	Interstate 65: Proposed Spur to U.S. 12- 20. . . . .	581
92	Interstate 69: Location East of Anderson. . . . .	584
93	Interstate 69: Alternative Locations from Pendleton to Fort Wayne. . . . .	585
94	Interstate 69: Alternative Locations from Indianapolis to Pendleton. . . . .	590
95	Interstate 69: Alternatives in the Huntington Reservoir Area . . . . .	597





## LIST OF FIGURES (Continued)

<u>Figure</u>		<u>Page</u>
96	Interstate 69: Allen County. . . . .	600
97	Interstate 69: Alternatives from Waterloo to the Indiana-Michigan State Line. . . . .	603
98	Interstate 69: Alternatives in the Lake Charles Area . . . . .	606
99	Interstate 69: Relocation at the Indiana-Michigan State Line . . . . .	608
100	Interstate 69: Fishers Area. . . . .	617
101	Interstate 70: Alternative Locations from Indianapolis to S.R. 1 . . . . .	625
102	Interstate 70: Additional Construction Costs as a Result of Alternate B. . . . .	628
103	Interstate 70: Alternative Locations for Terre Haute Bypass. . . . .	634
104	Interstate 70: Initial Relocation in Strip Mining Area . . . . .	637
105	Interstate 74: Alternatives from Covington to Indianapolis . . . . .	653
106	Tri-State: Location Alternatives . . . . .	674
107	Interstate 94: Access Alternatives to Chesterton . . . . .	686
108	Alternative Indiana Toll Road Routes. . . . .	695
109	Interstate 265: Location Alternatives. . . . .	699
110	Interstate 275: Alternatives . . . . .	705
111	Interstate 275: Locations Selected by Consultant . . . . .	707
112	Interstate 275: Final Location . . . . .	711
113	Interstate 275: Relocation West of Elizabethtown . . . . .	713



## LIST OF FIGURES (Continued)

<u>Figure</u>		<u>Page</u>
114	Interstate 69 Extension (Northeast Indianapolis Freeway) and I-465 Connector . . . . .	717
115	Interstate 64 Spur and Interstate 63: Traffic Assignments for 1990 . . . .	719
116	Interstate 294 Extension. . . . .	721
117	Interstate 164. . . . .	723
118	Status of Improvement of Indiana Interstate System as of December 31, 1960. . . . .	739
119	Status of Improvement of Indiana Interstate System as of January 1, 1964. . . .	743
120	Status of Improvement of Indiana Interstate System as of January 1, 1968 .	744
121	Status of Improvement of Indiana Interstate System as of December 31, 1971. . . . .	749
122	Status of Improvement of Indianapolis Interstates as of December 31, 1972 . . .	752
123	Status of Improvement of Indiana Interstate System as of December 31, 1972. . . . .	753
124	National Status of Improvement of Interstate System as of June 30, 1972. . . . .	755
125	Federal Aid Highway Program Financing . .	797
126	Interstate Federal Aid Financing: Apportionments, Releases, Obligations, and Collections in Indiana on a Fiscal Year Basis. . . . .	802
127	Interstate Federal Aid Financing: Apportionments, Obligations, and Collections in Indiana on a Cumulative Basis . . . . .	803
128	Social and Housing Characteristics Inner Loop Freeway Plan . . . . .	824



## ABSTRACT

Ripple, David Alan. Ph.D., Purdue University, December, 1973.  
The History of the Interstate Highway System in Indiana.  
Major Professor: Harold L. Michael.

This work is a reconstruction of the planning, development and implementation of the Interstate Highway Program in Indiana as well as the Nation. The historical data for this record was gathered from Federal reports, documents, and legislation; Federal Highway Administration documents and interviews; Indiana State Highway Commission records and interviews; and other transportation related agency reports and interviews throughout Indiana.

Because of the voluminous amount of data involved, a combination of the stages of the systems analysis process and the highway planning and programming process was used in the reconstruction and presentation of the historical record.

The work begins with a description of the traditional role of transportation in the economy and the role of government in highway development. The need for an interregional super highway system and the goals and objectives of the Interstate Program are documented.

The development of the Interstate Program is traced from its conception in the late 1930's to the landmark legislation in 1956. The highway needs and programs developed by numerous studies during this period are described in detail.

The Interstate Program as set forth by the Federal Aid Highway Act of 1956 and its evolution are described in terms of policies on construction time, the utilization of manpower, the use of material and equipment, and financing. Under





financing, the report covers in great depth the apportionment of funds, federal participation, the use of funds, administrative policy, right-of-way acquisition, the inclusion of toll roads in the Interstate System and the reimbursement to States for completed Interstate sections.

All programs are subject to an evolution in policies and standards which ultimately affect the ultimate product. The research covers Interstate route location and selection, the route alternative evaluation process, the public hearing process, the A-95 Review Process (Project Notification and Review Process), the decision-making process and interagency cooperation, the environmental statement process and highway impact guidelines, policies on multiple use and joint development, the evolution of design standards with a heavy emphasis on safety in design, the evolution of interchange location and spacing, federal policies on fund participation, the evolution of landscape design including billboard and junkyard control, the evolution of the land acquisition process and the relocation process and other processes and policies.

Leaving the national scene, the work concentrates on designation of the Interstate Routes in Indiana, the formulation of the Indiana Interstate Program, and the historical development of the Indiana System. A description of studies and events leading to the development of each Interstate Route is covered in great detail.

Finally, the report assesses the relationship between revenues, expenditures, and cost completion estimates on the Interstate System. The progress of the Indiana System toward completion is documented on a fiscal year basis. A gross overview of the benefits and impacts of Interstate development on the citizens of Indiana concludes the presentation.



## CHAPTER V

### EVOLUTION OF POLICIES AND STANDARDS

In order to understand the historical development of the Interstate Program, one must understand the policies and procedures of the agencies involved, and how these regulations affected the Interstate Program. It must also be recognized that policies and procedures, location and design criteria and evaluative methods, construction practices, and funding have all evolved in time and have subsequently affected the end product, the Interstate Highway System. To obtain this information extensive interviews were made with the personnel of the Indiana State Highway Commission and Division Office of the Federal Highway Administration. State records, Federal memoranda, and a variety of other sources were also reviewed to supplement and augment the information obtained from the personal interviews.

There were a variety of reasons for the evolution of criteria for the Interstate Program; however, most can be linked to new knowledge gained primarily through experience with highway programs and to the recognition of increasing public demands or rising expectations.

Early in the Interstate Program Indiana as well as much of the nation had little experience in designing freeways, particularly in urban areas. As highway research and experience became available from highway departments, universities and others, the knowledge gained in freeway design was translated into changes in design criteria. As the Interstate Program progressed, State highway departments gained additional knowledge through observing the operation of freeways which they had designed.





Even though improved design criteria had been developed from research and experience, economic restraints in the early part of the Program precluded construction of the Interstate to such improved standards. As the public and legislatures began to demand highways of safer design and began to stress the importance of economic, social and environmental considerations in highway location and design, Federal and State laws were eventually passed to allow greater public expenditures on such factors. Subsequently, revisions were made in guidelines and regulations reflecting the intent of these new laws that required the consideration of these factors.

During the Interstate Program, there have been changes in the procedures for determining and evaluating route locations, the public hearing and review process, the design process and standards, the land acquisition process, construction procedures, and maintenance procedures. New concepts have been developed such as multiple use of highway right-of-way, joint land use development, and highway beautification. New legislation has required evaluation of the effect of highway location and construction on the environment, control of billboards and junkyards and compensation of those dislocated by public construction.

This evolution in criteria has had a profound effect on the Interstate Program. The Interstate System is a better and safer highway system because of this evolution. However, the changes in criteria have increased the ultimate cost of the Program. The subsequent failure of apportionments to keep pace with the increasing cost has resulted in an increasingly drawn out Interstate Program. The delayed completion of the Interstate System may have also resulted in a delay of benefits from the completed System. On the other hand, changes have brought greater recognition of public needs and greater public input into the Program. The evolution has also brought about the recognition of the overall





impact of a highway on the community and of the need to consider social, economic and environmental effects of highways.

### Planning

This subsection covers planning criteria, its evolution, its application in Indiana, and its effect on Indiana policies and the Interstate Program.

#### Criteria for Corridor Selection and Mileage Designation

General criteria for selecting the Interstate corridors and for determining the length of the System was set forth by the interstate program studies and Federal highway legislation. In the 1939 study, Toll Roads and Free Roads, the considerations for toll route selection included conformity to the Congressional description (three north-south superhighways and three east-west superhighways); distribution of routes in relation to geography and population; coincidence with popular travel routes, important termini and reasonably direct routing; the optimum location for the collection of tolls; and coincidence with the heavy traffic flows of 1937.

The study Interregional Highways of 1944 utilized the following criteria in selecting the interstate corridors: connection of major population concentrations, major industrial concentrations, major agricultural concentrations, high motor vehicle ownership concentrations, major military and naval establishments, and war industry; relation to heaviest traffic demands; conformity with the strategic highway network; and provision of a consistent and integrated System. Reiterating the corridor selection criteria of Interregional Highways, the Federal-Aid Highway Act of 1944 stated that the Interstate was to be "so located as to connect by routes, as direct as practicable, the principal metropolitan areas, cities, and industrial centers, to serve



the national defense, and to connect at suitable border points with routes of continental importance in the Dominion of Canada and the Republic of Mexico."<sup>1</sup> In a policy declaration, the Federal Aid Highway Act of 1956 modified the corridor selection criteria such that service to local needs was to be given, to the extent feasible, equal consideration with service to interstate commerce.

A statement submitted August 15, 1955 by the Commissioner of the Bureau of Public Roads to the Senate Subcommittee on Roads of the Committee on Public Works listed the specific criteria that were to govern the selection by the States of mileage for inclusion in the Interstate System and that were to be used by the Bureau of Public Roads in evaluating the routes proposed by the States. The statement consisted of general selection standards and additional selection standards for urban areas; the latter appear in the next section - Route Location Procedure. The general selection standards included the following:

"(1) Service to cities of various population groups. The routes selected should connect as directly as possible the maximum number of cities of various population groups.

(2) Service to principal metropolitan areas. The routes selected should provide maximum service to principal metropolitan areas as well as to specific cities.

(3) Density of rural population. Routes should traverse the country's most populous bands of rural territory.

(4) Distribution of the whole population. Routes should have their principal termini in the larger cities and also pass enroute between these termini through or very close to the denser clusters of population in small towns and populous rural areas.

(5) Relation to manufacturing activity. The routes selected should provide transportation facilities for as much as possible of the manufacturing industry of the country. Locations where manufacturing activity exists in greatest volume are the points of origin and destination of large volumes of motor truck traffic for which service should be provided, as well as for passenger car traffic.





(6) Relation to agricultural production. Interstate System routes should traverse to the maximum extent possible the areas of high per acre value in marketed crop production.

(7) Relation to concentrations of motor vehicle ownership. Interstate System routes should be selected to traverse to the maximum extent possible areas having a high density of motor vehicle ownership.

(8) Relation to routes of strategic importance from the standpoint of national defense. The Interstate System should be designated to include the principal traffic routes of military importance.

(9) Relation to military and naval establishments and war industry. Routes of the Interstate System should be selected to serve the highway movement to and from military and naval establishments and war industries.

(10) Relation to routes of highest traffic volume. Interstate System routes should be selected in accord with the highest traffic volumes in the areas traversed, serving a share of the total highway movement greatly exceeding the proportion of the total highway mileage involved.

(11) Relation to principal topographic features. Consideration of topographic features is important in the selection of some Interstate System routes. Conformation of the land and the courses of principal rivers may influence to some extent the location of certain routes.

(12) Cooperation with the Department of Defense. One of the primary functions of the National System of Interstate Highways is to serve the national defense. Under the provisions of the Federal-Aid Highway Act of 1948 the Commissioner of Public Roads was directed, among other things, to invite the cooperation and suggestions of the Secretary of Defense. Such cooperation and suggestions of the national military establishment have been obtained in connection with the Interstate System routes previously designated. Continuing cooperation and suggestions will be secured in connection with any future designations."<sup>2</sup>

For the most part these standards were the same as those developed in the Interregional Highways study and used by the study in selecting the interregional routes.





In selecting routes for submission to the Bureau of Public Roads for approval as part of the Interstate System, the Indiana State Highway Commission closely followed the Federal criteria as set forth in the Interregional Highways study and considered the routes recommended by that study. In addition to the routes recommended by the Interregional Highways study, the Indiana State Highway Commission selected other routes for inclusion in the Interstate System that were thought to be of interstate importance, connected the metropolitan areas, served the greatest highway needs, provided the greatest service, and filled voids in the existing Interstate System.

The Federal-Aid Highway Act of 1944 limited the Interstate System to a length of 40,000 miles. The Interregional Highway study had recommended a system of approximately 39,000 miles. This was the optimum length of the interregional system based on that mileage (33,920 miles) which would provide the highest average daily traffic volume for the system plus 5000 miles for circumferential and distributor routes in urban areas. Congress had merely rounded the recommended length to 40,000 to allow for adjustments and corrections. In 1956, the Interstate System was lengthened to 41,000 miles; the additional mileage was for adjustments, corrections, and additional urban mileage. In January of 1968, Congress authorized further modifications and adjustments. In August of 1968, the Federal Aid Highway Act of 1968 authorized an additional 1500 miles for the System to improve its efficiency and service. Under section 16 of the 1968 Act, Federal Aid Primary highways that met Interstate Design standards and were logical additions or connections to the System could also be added to the System without charge against the mileage limitation.

As the Interstate System neared completion, the Secretary was authorized to "remove from designation, as



a part of the Interstate System, every segment of the System for which the States had not established a schedule of expenditures by July 1, 1973 for the completion of the segment within the time funds were appropriated for completion of the System."<sup>3</sup> If the States did not submit plans, specifications and estimates to the Secretary by July 1, 1975 for uncompleted segments of the Interstate System, the segment would also be removed from designation as part of the Interstate System.

With the authorization of an additional 1500 miles for the System in August of 1968, the States were asked to submit recommendations for additions to the Interstate System. The Federal Highway Administration memorandum to the States stated that "Interstate route additions selected under the new authorizations must conform to the same criteria used in the original 41,000-mile system designations. Essentially, these criteria were "(1) importance to national defense; (2) system integration - the value of the route as a connector between numerous centers of population and industry which generated interregional traffic; (3) importance to industry - meeting the transportation requirements of manufacturing, agricultural, mining and forestry enterprises in the area traversed; and (4) importance to rural and urban population."<sup>4</sup> Congress felt that the additional mileage authorization was needed to fill critical gaps in the System (which prevented "its efficient function as the nation's major continuous interconnected highway network"); to serve several cities over 100,000 population and several State capitals which were not now served by the System; to eliminate "missing segments on beltways, urban arterials and connectors"; and to eliminate "missing segments in areas that carry very heavy and still increasing direct defense traffic in addition to excessive non-defense traffic."<sup>5</sup>





In selecting possible routes for additions to the Interstate System, Indiana followed the Federal selection criteria very closely. In addition to the Federal criteria, Indiana utilized the same criteria as used in the original Interstate route selections - service to metropolitan areas, greatest highway needs, greatest service, and the elimination of voids in the Interstate System. As working guidelines, the States were asked to make selections based on the State's priority list and judgement. The State proposals for Interstate route addition had to be accompanied by appropriate justification data which included the estimated cost of the proposed addition; the projected traffic estimate; the total mileage of the proposed addition, including total estimated lane miles and estimated number of interchanges; and an explanation of the critical nature of the proposed new mileage, including critical time problems relating to construction scheduling.

Identification of any Interstate mileage to be deferred and reasons justifying the priority of the proposed added mileage over the deferred mileage were required. State proposals for route additions without mileage charge had to show that the proposed route met the prescribed selection criteria and Interstate design standards, and served as a logical addition or connection to the Interstate System.

The States generally asked for much more mileage than was available. In each State, Federal Highway Administration Division people were asked the same questions as the States - a priority list of recommendations, known additions needed for System continuity, and the service provided by each recommendation. The final selection of the mileage to be added to the System was made at the Washington Office of Federal Highway Administration and was presumably based on need and considered judgement.





## Route Location Procedure

The preceding planning subsection has described criteria for the selection of general corridors. However, to a certain extent the selection criteria were utilized in further defining the route location alternatives within a corridor, particularly in rural areas.

Location Criteria. The study Interregional Highways of 1944 considered the location of interstate routes in urban areas and established guidelines for their location. The study documented the interrelation between transportation and urban growth and stated that the interregional routes should conform to the future shape of cities as well as the existing urban travel pattern and land use pattern of the urban centers. According to the interregional highway report, the following principles served as guides: connection with city approach routes, penetration of the city, location internally through wedges of undeveloped land, utilization of circumferential and distribution routes, interface with traffic generating foci and terminals, compatibility with other transportation modes, minimization of street intersections, and consistency with urban planning.

A statement submitted on August 15, 1955, by the Commissioner of the Bureau of Public Roads to the Subcommittee on Roads of the Committee on Public Works of the Senate listed the criteria to be used by the States in route selection in urban areas. These same criteria were used by the Bureau of Public Roads in evaluating the States' proposals. The standards established by the Bureau of Public Roads for route selection in urban areas were a restatement of those developed in the Interregional Highways study. A discussion and statement of the standards follows.

Although route location near an urban area is primarily a matter of study and determination, route selection should be made cooperatively by the State highway department and



the local planning and highway officials based on comprehensive origin and destination travel studies. The State highway department has the primary responsibility of determining the location of the System leading into urban areas and has knowledge of the travel patterns on the rural sections of the Interstate System. Within the urban area, the Interstate System would become a part of the urban transportation network and would carry intraurban traffic over which the local authorities have responsibility and knowledge. To solve the problem of the collection and distribution of traffic in urban areas utilizing the Interstate System, cooperation is essential to insure the proper interface of facilities heading into the city with facilities in the city. If numerous local authorities exist in a metropolitan area, an overall authority would be desirable to assure cooperation. These factors were summarized by the Bureau of Public Roads:

"(1) Connection with city approach routes. For the service of Interstate System traffic and other traffic bound in and out of the city to and from exterior points, the routes selected should provide for convenient collection and delivery. Although the Interstate routes must bear a proper relation in location and character to other parts of the street system, they will be the routes of principal service to the Interstate System traffic."<sup>6</sup>

Bypasses are known to save valuable time to through traffic; however, as a large proportion of the total trips has a trip end within the urban area, the advantages of bypassing for through traffic must be weighed against traffic having a trip end in the urban area. As the urban area increases in size, a greater proportion of the traffic on the Interstate has a trip end in the urban area; this implies that the collection and distribution of interstate traffic in the urban area was more important than bypassing through traffic.



As movement to the central business district is the largest movement within the urban area, the Interstate route should penetrate the urban area to within close proximity of the urban core. These routes are generally built in the fringe area of the central business district since land value is lower than that of the central business district and mixed land uses and speculation have caused deterioration. Again a Bureau of Public Roads summary stated:

"(2) Penetration of city. At the approaches to cities and particularly the larger cities, a very large part of the traffic on the Interstate System originates in or is destined to the city itself. Distributing routes within cities should be provided in addition to circumferential routes which serve to bypass the traffic that is not destined for the city."<sup>7</sup>

Since development of the urban area generally followed transportation corridors radiating from the central business district, the urban areas have been divided into wedges by the major transportation corridors. The density of development within the wedge varies from the highest in close proximity to the transportation corridor to the lowest in the interior of wedge where accessibility is a problem. Thus, the location of a new route between older transportation corridors and through the center of the wedge would stimulate the development of the interior of the wedge and assure a less costly right-of-way location. The Bureau stated:

"(3) Location on undeveloped land. To the extent consistent with other requirements, undeveloped land offers the best possible locations for routes entering a city."<sup>8</sup>

Circumferential routes are needed in large urban areas to serve intraurban traffic with origins and destinations in the development wedges, to provide an adequate collection and distribution system for interurban traffic, and to serve







as a bypass for through traffic. Depending on the size of the urban area and travel patterns, a circumferential route around a part of the urban area may be adequate.

"(4) Circumferential and distributing routes. Routes which avoid the business centers of cities are needed to serve traffic bound to or from points other than the center of the city. Such routes may be so located as to serve both as arteries for through traffic around the city between various approach highways and as distribution routes for the movement of traffic with local origins and destinations to and from the various quarters of the city. The pattern of such routes depends upon the topography and plan of each particular city. At many of the relatively large cities the need is for routes completely encircling the city. In some of the larger cities a belt route near the central business district may be needed in addition to an outer circumferential route."<sup>9</sup>

Major traffic generators and mode interfaces based on future traffic patterns should be considered in route location. Parking garages and links with bus and trucks lines should also be considered.

"(5) Relation to traffic generating focal points and transportation terminals. Railway terminals, both passenger and freight, wharves and docks, and airports generate large volumes of street and highway traffic associated with the essential interchanges between the several modes of transportation. The location of the Interstate System routes at cities should be so placed as to give convenient express service to these various major traffic-generating locations within and in the vicinity of cities and also to the business center of the city and main industrial areas. The location of the Interstate System should permit and encourage a desirable coordination of highway transportation with rail, water and air transportation."<sup>10</sup>

To minimize the disruption to the existing transportation network, the Interstate should be located to minimize the number of intersections; in turn, this will minimize the number of necessary road closures and the number of grade



separations. Location along another natural or man-made barrier, such as a river or railroad, would reduce the number of intersections needed. A location which cuts diagonally across a grid transportation network would result in the greatest number of intersections.

As major transportation routes influence the shape of urban growth, the route chosen should be consistent with the urban transportation plan for the urban area and should anticipate the direction of urban growth. Coordination of the Interstate route location with urban planning enables city agencies to secure land along the intended route for services required for new development. This coordination allows the city to purchase land before the choice of sites is reduced and before land values increase due to new development.

"(6) Relation to urban planning. Interstate System routes will provide for only a small portion of the movements of traffic in most cities. The routes should be located and designed to be an integral part of the entire urban transportation plan."

"(7) Civil defense. The Interstate System routes to be provided in and near any city should be carefully studied and integrated with the planning for 'civilian defense.'"11

The Indiana State Highway Commission closely followed the Federal selection criteria for rural and urban areas in defining the study corridors in more detail and determining route alternatives within the corridors. The Indiana highway location engineers also utilized several general guidelines in determining a study corridor and possible route location alternatives within it. The Interstate System initially followed existing routes because this was an easy way of designating the Interstate routes in 1947; thus, the study corridor for the Interstate route was often centered on an existing route. In all cases, the study corridor was defined by node points at major metropolitan





areas and by control points at metropolitan areas of 50,000 population or more. Travel origin and destination studies were used to locate the general route within the study corridor. Since urban areas were major traffic generators, the route within the study corridor would be drawn toward urban areas of large population. As a general rule, it was cheaper to build the Interstate route on new right-of-way than utilize the right-of-way of an existing highway. Utilization of an old alignment resulted in additional expenditures for frontage roads to serve property (which had developed along the route), in higher costs for wider right-of-way because developed land had to be purchased, and in higher construction costs for bridges because development would require more grade separation structures. In locating the route alternatives, Indiana generally selected lines following the drainage lines to reduce the cost of cuts and fills; attempted to follow property lines when possible to hold severance costs to a minimum; and attempted to avoid all structures, recreation facilities, churches, cemeteries, schools, other public and semi-public institutions, subdivisions, and major land use developments.

Indiana's Route Location Process. Although there is no manual which describes the steps in the route location process or the route location study, the Indiana State Highway Commission follows a definite procedure in locating and studying route alternatives. The State must also review route location determinants as required by the Bureau of Public Roads in the "Public Hearings and Location Approval" memorandum.<sup>12</sup>

The general source of new highway projects is the State's highway needs study which provides information on deficiencies of the existing highway network. Since the needs study told nothing about the need for a new route, the State needs study was only used to a limited degree in the





Interstate Program. A review of present and future capacity deficiencies within the major corridors would give a better indication of the need for a new facility in a corridor. However, because the Interstate System had to be built nationwide and the need for the System had already been substantiated, Indiana was not concerned with justifying the System.

Prior to any action on a specific project, the project must be programmed for planning (route location study) in the State's biennial construction program. The programming of individual sections of the Interstate depended on the construction priorities as determined by the State.

When a project appears in the improvement program, work begins on the route location study. The first step in the route location study is to determine the purpose or function of the route. The route may provide access to land, serve through traffic only, collect and distribute traffic for through routes or a combination of the preceding. The functional classification of a facility provides information about the design and location of the facility.

The study area or study corridor is next delimited. The study area is primarily defined by determining the area of traffic needs between logical termini of the routes. The width of the study corridor generally increases as the distance between the termini increase and as barriers cause deviation from a straight line connecting the termini. If land values vary little in the corridor as is generally true in rural areas, the study corridor is very narrow since any deviation from a straight line would increase construction and right-of-way costs.

In an urban area, a study corridor is chosen as near as possible to a straight line between the termini, but through the area of least capital cost, particularly right-of-way cost. In determining the study corridor in developed



areas, greater consideration is given to the environmental impact of the highway facility. To a great extent, the study corridor is determined by whether the location will enhance or destroy a residential area.

Consideration is given to the existing and projected land use within the study corridor. The sources of land use information are the land use plans of local governmental agencies and aerial maps. If the local agency has a land use plan, the Indiana State Highway Commission attempts to implement and enhance the land use plan rather than destroy it. In cities where a comprehensive transportation process is underway, a land use projection has generally been made and is taken into consideration in the location study. In cases where land use plans do not exist, the Indiana State Highway Commission makes projections based on the dichotomy of the neighborhood. Although future land use area is not calculated, the expansion of a community is reflected in expanded traffic demands and is considered in route location such that the route chosen would not hamper future growth and may be used to guide development.

The lack of a viable local planning authority or viable local transportation planning process is detrimental to the route location process. Since a single project cannot solve all the local transportation problems, the coordination of projects at both the State, county and local level is needed. Because future land use is a determinant of route location, the lack of a future land use plan means the State has little information to properly locate the facility. Subsequently, the State will develop the future land use information it needs and the locality will lose some power to determine its own future land use.

The selection of route alternatives is based on capital cost, traffic service and impact on the community - social, economic and environmental. Indiana generally selects





alternatives which follow as straight a line as possible, yet avoid natural or physical barriers (particularly existing development). Since every location is a compromise of many desires, the alternatives may represent various balances of considerations. For example, the location which is ideal for through traffic may not be the location which provides the best service to the community; thus, the possible alternatives depend on the variation in weight or importance attached to traffic service for through traffic versus local traffic.

Existing and projected traffic may be considered before or after the selection of alternatives. The Indiana State Highway Commission forecasts future traffic by projecting traffic growth trends with adjustments for land use development, community growth potential and the type of development anticipated. Although rural and urban traffic forecasting methods are similiar, the ISHC takes into consideration possible differences in the capacity characteristics of rural and urban highways. The ISHC followed the Bureau of Public Roads instructional memorandum for forecasting traffic on the Interstate System. The formula devised for projecting Interstate traffic was based on traffic counts and operators licenses.

The final step of the route location study is the evaluation of route alternatives. The criteria used to evaluate route alternatives is similar to the criteria used to select the alternatives. This includes the consideration of traffic service, facility operations, the incorporation of safety features, environmental effects, effects on existing development, the effect on the community's growth potential and goals, and capital cost. Unfortunately many of the considerations must be tied to the availability of dollars. Although a particular location may provide the best ultimate solution, the State must settle for the financially viable solution of





that time because financial resources are limited and a variety of needs vie for these resources. On the other hand, funding is not crucial in the evaluation of alternatives since the same funds will generally be used for all alternatives.

The Federal Highway Administration requires all feasible route location alternatives to be considered. All significant differences between the selected alternatives must be identified and considered. The final location decision must be documented by the comparison of alternatives based on the consideration of specific determinants. These determinants include national defense; economic activity; employment; recreation; fire protection; aesthetics; public utilities; safety; residential character and location; religious institutions and practices; rights and freedoms of individuals; conduct and financing of government; conservation; property values; replacement housing; education and disruption of school district operations; specific numbers of families and businesses displaced; engineering, right-of-way and construction costs for proposed highway facilities and related transportation facilities; maintenance of highway facilities and other transportation facilities; use of highways and other transportation facilities, and user cost; and operation of highway facilities and other transportation facilities during construction and following completion.<sup>13</sup> Although much of the documentation for the final decision remains in the State highway department files, the Federal Highway Administration may review the files. The highlights of the alternative comparison process are summarized in the route location study which is presented at the corridor public hearing and accompanies the request for approval of the route location after the public hearing is conducted.



## Evolution of the Route Alternative Evaluation Process

Theoretically the State is not to determine the final route location until after the corridor public hearing is held and public opinion is recorded and analyzed. However, the State must determine and compare the consequences of the alternatives to provide the public with sufficient information at the corridor hearing. In comparing the alternatives, the State eliminates those which are financially infeasible and publically unacceptable, and may select a preferred alternative for presentation at the corridor hearing. In the final evaluation after the public hearing, the State may recommend to the Federal Highway Administration a location that costs more than the initially preferred alternative if there is sufficient and justified objection to a particular route.

Criteria Used to Evaluate Alternatives. The balance between local versus through traffic service is a strong consideration in evaluating alternatives. Although the Interstate System was to initially serve through or long distance traffic, Congress also required the Interstate System to serve the local traffic in the corridor when practical, suitable and feasible. When Congress required a minimum of four lanes on the Interstate System for improved safety in 1966, many factors in traffic service were no longer considered if the capacity provided was above that needed for the design year. In urban areas, the Federal Highway Administration established a maximum number of lanes based on the size of the metropolitan area; this requirement restricted the amount of Interstate service for local traffic or short trips. Subsequently, alternative locations and spacings of interchanges had further direct affect on the service to through versus local traffic.

One important route location consideration is the location of intermediate population concentrations which generally pull the study corridor from a straight line between termini. The amount of deviation from the straight line depends on a





comparison between traffic service and additional construction cost. Generally, as long as increased user cost to the through traffic and increased construction cost are offset by a reduction in user cost to local traffic and an increase in local traffic, the route is pulled from the straight line.

Traffic diversion from parallel facilities is also a consideration in the comparison of alternatives. A bypass will divert through traffic from urban areas, reducing congestion in the urban area. An expressway may divert through traffic from arterials which cut through neighborhoods.

The social, economic and environmental impact of each alternative is also considered in the evaluation. The number of acres and structures to be acquired, the number of persons and businesses to be dislocated, and the right-of-way and severance cost to be incurred are some indicators of social impact. Consideration is also given to the effect on community services including utilities, protection services, school districts, religious institutions, and other public and quasi-public services. The economic impact of an alternative is typically reflected in retail sales, property values, and the local tax base. The effect of an alternative on recreation areas, parks, natural and historic landmarks, noise, air, and water is its environmental impact. Local impact is obviously a more important criterion of evaluation in urban areas than rural areas because of a greater possibility of conflict with development in urban areas.

Drainage, the removal of land from production and local traffic circulation are often more predominant factors of highway impact in rural areas. However, drainage only becomes a predominant consideration when major streams are crossed, and involves a comparison of capital costs. Land productivity and severance damages are generally reflected in right-of-way costs when alternatives are compared. The control of access and the location of grade separations affect local traffic circulation.





How destructive an alternative is to the land use pattern in the immediate future and how well an alternative relates to a desirable pattern of land use in the distant future are facets to be considered. However, the effect on long range land use is considered more important than the effect on existing land use. Alternatives are compared on how well they complement the land use plans of the future.

Finally, alternatives are compared on the basis of costs. Cost considerations include right-of-way, construction, maintenance, and operation. The terrain through which each alternative passes is a major factor reflected in construction cost.

Of the three major criterion - traffic service, local impact and cost, traffic service has often been the most important factor in evaluating alternatives. However, the relative importance of the factors varies with each set of alternatives compared. For example, local impact may become the predominant criterion in a highly developed urban area and a subordinate criterion in a sparsely populated rural area.

Evaluation of Economic Analysis Techniques. The deemphasis of the benefit-cost ratio as a means of comparing alternatives is perhaps the most significant evolution in the utilization of economic analysis techniques during the Interstate Program. The benefit-cost ratio came into its own just prior to the advent of the Federal Aid Highway Act of 1956. The benefit-cost ratio is the ratio of highway user cost to capital and maintenance cost and was utilized in comparing location alternatives. Early in the Interstate Program, the benefit-cost ratio carried considerable weight in the comparison of alternatives; however, it was not the absolute factor in the final decision. Over a period of time the emphasis on the benefit-cost ratio as one of the major factors in alternative comparisons has declined to a point where it is now a secondary factor utilized to support a decision based on more important factors.



Originally the Bureau of Public Roads required the universal use of the benefit-cost ratio to justify all improvements because it was considered a good evaluation tool. The ratio tended to bring about a uniformity of justification for projects throughout the nation. However, it is not clear that the ratio did indeed accomplish this or was used for such a purpose. Undoubtedly, the emphasis on the ratio was to a large extent due to the prevailing emphasis on cost by Congress and general cost consciousness.

The benefit-cost ratio technique defines user benefits as a reduction in user cost. Thus, the technique involves the differences in road user costs and highway costs for each pair of alternatives within the group of alternatives being considered. The ratio is the difference in annual road user cost for a pair of alternatives over the difference in annual highway costs for the same alternatives. Road user cost includes the annual vehicle operating cost and travel time cost for each alternative, and highway cost encompasses the annual capital, maintenance and operating cost for each alternative. A simple benefit-cost ratio analysis is a comparison of the alternatives to the existing condition to determine the alternative with the highest benefit cost ratio. Incremental benefit-cost analysis involves the paired comparison of alternatives according to increasing highway costs to determine the benefit-cost ratio for increments in highway cost; the alternative having the highest highway cost whose incremental benefit-cost ratio is greater than or equal to one is usually considered to be desirable.

Since the benefit-cost ratio technique came into vogue in 1956 after only a couple years of extensive use, there was little knowledge of the limitations of the method. Several factors in the equation required the assignment of subjective values. The American Association of State Highway Officials developed a manual for the benefit-cost ratio





analyses including tables of values for the various benefits and costs. Nevertheless, possible variation of the value of time with the length of trip and purpose of trip was not included. The selection of the vestcharge or discount rate and life span of various design elements was also somewhat subjective.

In comparing alternatives, user benefits must be determined for the entire corridor. Since each alternative diverts traffic differently from other facilities in the corridor, user benefits on the other facilities will change also. A corollary to this requirement is that the volumes for the alternatives being compared must be equal during the period of analysis; if the user cost per vehicle remains constant and the volume carried increases, the user cost will be higher for the alternative carrying the greater volume. Calculation of user benefits on the basis of the entire corridor will alleviate this problem.

Another limitation to the benefit-cost ratio is that the alternatives being compared must exhibit similar traffic patterns; otherwise, the traffic service to a community may be totally different. The benefit-cost ratio ignores differences in traffic service to the community. Hence, the use of the benefit-cost ratio to compare alternatives serving different travel patterns is questionable.

Even though alternatives may have similar present traffic patterns and volumes, the future traffic patterns and volumes may differ tremendously. Alternatives may also create different future land use patterns.

The benefit-cost ratio further more does not incorporate all the criteria for evaluating alternatives. The method considers only user benefits and excludes all community benefit considerations.

The deemphasis of the benefit-cost ratio is an evolution of time, increased knowledge, and rising public expectation;





and cannot be attributed directly to the Interstate Program. In the early stages of the Interstate Program, Congress emphasized cost as the predominant factor. Fifteen years later greater emphasis was placed on nonquantifiable factors such as economic, social and environmental impact. The shift in emphasis is due to public desire that social and environmental (community benefits) factors be considered to a higher degree than before. The benefit-cost ratio merely involved user benefits (quantifiable factors). Thus, the benefit-cost ratio assumed a lesser role in the evaluation of alternatives as community benefits (nonquantifiable factors) become increasingly important. This is particularly true in urban areas where social and environmental considerations are prime; cost is often reduced to the level of insignificance in such decisions.

The Interstate Program did lead to the deemphasis of the benefit-cost ratio as a major tool in the route evaluation process and the need to give greater weight to non-user considerations in the route evaluation process. The sheer magnitude of the Interstate Program, however, meant that location alternatives could not be studied in great detail and that evaluation of route alternatives had to be compressed into a shorter span of time. Since the benefit-cost ratio method covered only one aspect of the evaluation process, its use was quickly deemphasized.

The Indiana State Highway Commission utilized the American Association of State Highway Officials' benefit-cost ratio method for the comparison of alternatives early in the Interstate Program because the Bureau of Public Roads made its use nearly mandatory. However, the Indiana highway planners soon recognized the limitations of the benefit-cost ratio method in evaluating route alternatives and relegated the method to a minor decision-making tool, which was only useful within specific constraints. Indiana in the early



1970's began using annual road user cost analysis to compare alternatives on the traffic service provided. The alternative with the lowest road user cost, which is a measure of highway user benefit, is the preferable alternative if the capital costs are comparable. The annual road user cost method eliminates capital cost from the equation such that traffic service is emphasized and capital cost is a separate consideration.

Economic analysis methods have always been a tool to aid in the evaluation of alternatives and have never been intended as the ultimate decision. These methods generally deal with only the user benefits of the particular route alternative, and non-user or community benefits have to be considered separately.

With increased emphasis on non-user benefits or community benefits in the evaluation of route alternatives, other methods were utilized to include such considerations in the decision-making process. Most methods are based on some aspect of cost-effectiveness analysis.

### Evolution of the Decision-Making Process

The decision-making process has grown increasingly more complex over a period of time due to an increase in the number of factors considered and the number of agencies involved in the process. Because the public demanded greater consideration of non-user benefits in the location of highway facilities, Congress responded with new legislation and policies, and FHWA regulations have evolved to carry out the intent of the new legislation. The project review and evaluation process has also become more sophisticated, involving more agencies in the review process.

Overview of the Decision-Making Process. The general transportation decision-making process involves three major components - road user cost, non-user cost or community





benefits and highway cost. These components coincide with the major criteria for route location and for alternative evaluation - traffic service, local impact and capital cost. Road user cost includes the motor vehicle operating cost, accident cost, travel time costs and comfort and convenience costs. Nonuser consequences of highway location may be categorized in the following areas: aesthetics, agriculture, commercial, community government, construction of highways, employment, environment, industrial, institutions, population, public utilities, residential neighborhoods, local road user, spatial and geographical changes, and urban form and development.<sup>14</sup> Special attention must also be given to community values and objectives in the decision process. Highway cost includes expenditures for engineering, right-of-way, construction, maintenance, and operation.

The decision-making process involves the identification of the relevant factors in the three major components, the determination of the interrelationships of these factors, and the recognition of possible trade-offs between the factors. The process is complicated by the fact that nonuser benefits are generally qualitative and nonpriced, although a few may be quantified but not priced; whereas, user benefits and highway costs are generally quantifiable and priceable. The overall decision is further complicated by transfers within the various nonuser factors and by trade-offs of economy of transportation (user and highway costs) to lessen adverse community consequences.

A cost-effectiveness type of analysis may assist the decision-maker in choosing between route location alternatives when the consequences of the proposed facility involve quantifiable and nonquantifiable factors. This method identifies trade-offs between the highway, the user, and the community. Alternatives are compared in terms of quantifiable factors when possible and in terms of qualitative descriptions for other factors. "Consequences can be described to





the extent that the decision-maker may readily visualize the differences in major factors such as relocation of families and businesses, probable changes in wholesale and retail trade volumes and patterns, changes in environmental factors, and changes in community aesthetics."<sup>15</sup> Cost-effectiveness schemes generally involve the subjective ranking, rating or weighting of the consequences for each alternative. The subjective weightings may be derived by the direct input of various interest groups or citizens groups in the community or by the planner. This method remains a tool for the decision maker, and he must make his own ranking of the factors in reaching a final decision.

Despite the short-comings of cost-effectiveness analysis, it offers considerable assistance to the decision-maker and to the general public in understanding the comparative merits of route location or design alternatives under consideration. The utility of the method lies in its ability to identify the relevant factors and describe their interactions and tradeoffs when the decision process becomes too complex to comprehend without technical assistance.

The Decision-Making Process in Indiana. The process has grown more complex, and community considerations are now an integral part of the process. Community consequences, however, have always been considered to some degree by the planners and decision-makers in the location and evaluation of route alternatives. Early in the Interstate Program, the public interest, as expressed by their representatives in government, showed a preoccupation with cost that limited the extent to which community consequences could be considered in the evaluation process. Today, a record must be kept to show that nonuser consequences are considered in the process.

Since a formula cannot be developed to give "the solution" to an evaluation of alternatives involving complex factors, professional judgement by the decision-makers becomes necessary.



Because subjective judgement is ultimately involved in the selection of the preferable alternative, the review and approval by many agencies using personnel from many disciplines is necessary to make the final selection. The reviews insure that all consequences of a decision are considered and that the interaction of factors has been investigated.

Although direct cost-effectiveness analysis is not utilized to identify trade-offs, the ISHC and other agencies involved in the decision consider the consequences of alternatives and identify (in generalized terms without cost figures) the trade-offs between and within the components of highway cost, user benefits and nonuser benefits. An increase in highway cost and user cost may be explored in the desire to reduce large adverse consequences. The decision-making process in Indiana is best characterized as a collective decision making process in view of all those involved. The selection of the final route or design is made by a committee composed of representatives from the Indiana State Highway Commission, the local government, and the Federal Highway Administration. Throughout the decision process, there is also interaction with the agencies which will eventually review the alternative.

The evolution of the decision-making process in Indiana is characterized by the involvement of more people or agencies in the overall decision and in the review process. The process may also be characterized by a greater emphasis on non-user consequences - economic, social and environmental impacts - in the evaluation of route and design alternatives.

#### Evolution of the Review Process

It has always been the prerogative of the State to select the route location and design alternatives to be studied. After exhaustive study of the alternatives prior





to a public hearing, the State presents their preferred alternative to the Federal Highway Administration for review and concurrence. Although the Federal Highway Administration's role is primarily one of review, this does not restrict the Federal Highway Administration from suggesting other alternatives during or after the State's evaluation process.

The Federal Highway Administration reviews the State's alternatives based on the State's analysis of the alternatives. If the State's alternatives exhaust all feasible possibilities, the Federal Highway Administration may agree with the State's preferred alternative, agree with the State's recommendation with comments, or suggest further study of one or more alternatives.

Through the review process, the Federal Highway Administration has the authority to pressure a State into studying other alternatives if evidence exists that possible alternatives were overlooked. How adamant the Federal Highway Administration is in a particular situation depends on how strong a case the Federal Highway Administration can develop. If the situation involves the State's opinion against the Federal Highway Administration's opinion, the Federal agency will make its point of view known; and if the Federal Highway Administration fails to persuade the State, the Federal Highway Administration usually backs off graciously. However, if the interaction involves a policy or law that requires the exploration of other alternatives, the Federal Highway Administration will require the exploration of other alternatives if Federal funds are to be utilized. This description is true for all aspects of the transportation process - planning, design, right-of-way acquisition and construction.

In the review of route evaluation studies and the final location or design decision after the public hearing, the





Federal Highway Administration investigates the economic analyses made and the factors considered. Only in very unique situations are social and environmental factors sufficiently insignificant that alternatives may be compared on the basis of user cost analysis alone.

The Federal Highway Administration currently (1972) considers factors with social and environmental components as the most important. If highway costs and user benefits are nearly equal, the decision should be made on the basis of social and environmental factors. The Federal Highway Administration may arbitrarily assign ten factors, varying from project to project, which they consider important in making a location decision for the project being evaluated; if all but one factor proves to be equal, the differentiating factor should determine the decision unless there is some overriding reason for not deciding in such a manner. For example, if the cost of construction is higher on one alternative, yet the alternative solves the social and environmental problems of a highway location in that corridor, construction cost will become a lesser consideration. In particular, the Federal Highway Administration reviews the route and design evaluation studies and final recommendations to insure that the factors set forth by the "Public Hearings and Location Approval" policy and procedure memorandum have been considered. Final approval of the recommendation on location or design cannot be given until a formal public hearing is held or the opportunity for a hearing afforded and the transcript and certificate of consideration of economic, social and environmental effects have been forwarded. Most of the provisions of the memorandum since have been placed into law by the Federal Aid Highway Acts of 1968 and 1970. Because the memorandum is a regulation, the only flexibility the Federal Highway Administration has in its application is



the determination of what factors are applicable and should be considered in a particular project.

Public Participation and the Public Hearing Process.

With the advent of new Federal regulations and measures initiated by Indiana, the Indiana State Highway Commission has grown more responsive to public goals and has begun to consider a wider range of factors in the evaluation of location and design alternatives. The Federal policy and procedure memorandum "Public Hearings and Location Approval" codifies most of the Federal regulations on public hearings and alternative evaluations. The intent of the policy and procedure memorandum is to insure "that highway locations and designs reflect and are consistent with Federal, State, and local goals and objectives."<sup>16</sup>

Consequently, the procedures afford the opportunity for public participation in the evaluation of highway location and design alternatives by the State highway department prior to the submission of the final recommendation to the Federal Highway Administration for approval. The memorandum also requires the State to consider a wide range of factors in evaluating location and design alternatives and provides for coordination of the proposal with public and private interests.

When a State highway department begins to evaluate the alternatives for developing or improving a traffic corridor, it has to obtain the views of that State's resources, recreation and planning agencies, of those Federal agencies and local officials and agencies, and of those public advisory groups that will be interested in or affected by the highway. The State must also maintain a list of agencies and advisory groups to be given notice of a highway improvement. The Federal Highway Administration encourages the States to hold public hearings or informal public meetings in addition to the formal public hearings. These informal





hearings may be held before or during the evaluation of alternatives to inform the public about the highway proposals and to obtain information from the public that may affect the scope of the study, the alternatives considered and factors reviewed in the evaluation of the alternatives.

The public hearing process has undergone drastic changes during the Interstate Program. The formal public hearing was first required by the Federal Aid Highway Act of 1956 for all Federal aid highway projects involving the bypassing or penetration of any urbanized area, either incorporated or unincorporated. The State highway had to certify that a public hearing was held or the opportunity for a hearing was afforded and that the economic effects of the highway location had been considered. The hearing transcript and certification had to be submitted to the Bureau of Public Roads before the final detailed route location could be approved. In 1958, the formal public hearing requirement was extended to rural areas, through which the Interstate System passed, and became a part of the United States Code. The Federal Aid Highway Act of 1968 brought about a drastic change in the factors to be considered at a public hearing. Besides the economic effect of highway location, the public hearings were now to consider the social effects of highway location, the impact of the highway on the environment, and the consistency of the highway development with the goals and objectives of urban planning as proclaimed by the community.

A major revision of the policy and procedure memorandum on public hearings in January of 1969 introduced the two hearing requirement. A corridor public hearing is to be held before the State highway department decides on a particular route location and before the recommended route location can be approved by the Federal Highway Administration. This hearing affords the public the opportunity to participate in





determinating the need for an improvement and the location of the improvement and to comment on the economic, social and environmental effects of the location alternatives.

After the location is approved by the Federal Highway Administration, a highway design public hearing is to be held before the State highway department is committed to a specific design. The design public hearing is held when the design has progressed to the point where all property takings can be legally described. This hearing affords the public the opportunity to participate in the determination of the specific location and major design features and to comment on the economic, social and environmental effects of the design alternatives. In addition to the discussion of the development proposals, the State highway officials are required by the January 1969 memorandum on public hearings and location approval to explain the relocation assistance program and the relocation assistance payments available. With the passage of the National Environmental Policy Act of 1969 an environmental impact statement also has to be approved by the Federal Highway Administration before the public hearing can be held and the environmental impact statement must be summarized in the hearing itself.

Since there were no State laws or statutes establishing public hearing procedures, Indiana's public hearing procedures are based on the Federal Highway Administration policy and procedure memoranda on public hearings.<sup>17</sup> In addition to these memoranda, environmental declarations are necessary for the approval of an improvement as set forth in Federal Highway Administration policy and procedure memoranda on environmental policy, and are an integral part of the hearing procedure.<sup>18</sup> Although there is no Indiana law which requires public hearings on nonfederal aid projects, it is an established policy of the Indiana State Highway Commission to hold public hearings on all nonfederal aid projects using the same hearing procedures as federal aid projects with the exclusion of the environmental impact statement.



The public hearing process can be broken into the following general stages: publication of the notice offering the opportunity of a public hearing, publication of the notice of a public hearing, conduct of the public hearing, preparation and action on the hearing transcript, publication of the notice describing the location or design for which approval is being requested, and publication of the notice that the location or design has been approved by the Federal Highway Administration.

**Notice Offering Public Hearing.** After the ISHC, or, in rare cases, a consultant has completed the preliminary survey and the Indiana State Highway Commission Division of Planning has reviewed the access control features (interchanges, grade separations, road closures, and access or frontage roads) with the local officials and Federal Highway Administration, the public hearing process begins. Depending on whether a corridor or a design hearing is to be held, the Planning Division develops information on the various route alternatives, or the Design Division develops information on the various design alternatives. The environmental impact statement is then prepared by the Planning Division or updated by the Design Division. In Indiana, the head of the Roadside Development Division serves as the environmental impact officer who coordinates the environmental impact process and forwards the statement to the Federal Highway Administration for approval. The Planning Information Officer, the head of the Public Hearing Section and moderator for the public hearings, utilizes the summary of the environmental impact statement report in his public hearing presentation. The environmental impact statement is also sent to various agencies, which have an interest in the improvement or whose area of jurisdiction will be affected by the improvement, for review and comment. After the environmental impact statement and agency comments are forwarded to the Federal Highway Administration and the





statement is approved (or in some cases, after the statement has been mailed to various agencies for comment), the "legal notice of planned improvement" (notice of an opportunity for a public hearing) is published twice in a newspaper having general circulation in the vicinity of the proposed improvement and in any newspaper having a substantial circulation in the area concerned.

The "legal notice of planned improvement" includes a description of the project, the anticipated date of construction; a statement that those who own the needed right-of-way will be contacted; a notification that the improvement study report, written reviews and comments and the environmental impact statement are available for examination at the district or main highway office; and the procedure for requesting a public hearing.

If no request is received twenty-one days after the first notice or fourteen days after the second notice, the Federal Highway Administration is informed of the fact and the hearing need not be held. If an individual requests a public hearing and the reason for the request is strictly personal, the Indiana State Highway Commission may attempt to answer the individuals's private questions and request that he sign a waiver of the public hearing if his demands have been satisfied. If the proposed location or design changes from that of the original notice of an opportunity for a hearing such that different social, economic and environmental effects may result or different right-of-way is required, the opportunity for another public hearing must be offered.

When the improvement involves substantial right-of-way and displacement, the State may hold the public hearing without a formal request. In other words, the notice of an opportunity for a public hearing may be skipped provided that the State holds a public hearing. If a request is received for a hearing and a waiver of the hearing has not been signed in





the case of a single request, the local officials are contacted to make the arrangements for the hearing.

Notice of Public Hearing. Prior to the holding of the formal hearing, the State highway department is required to publish a "legal notice of public hearing" thirty to forty days and five to twelve days before the date of the hearing. Federal regulations require that the notice be published at least twice in a newspaper having general circulation in the vicinity of the proposed improvement and in any newspaper having a substantial circulation in the area concerned such as a local community newspaper. In addition to the publication of the formal notice of the public hearing, the State highway department must send notices to "appropriate news media, the State's resource, recreation and planning agencies, and appropriate representatives of the Departments of Interior and Housing and Urban Planning"; "other federal agencies, and local public officials, public advisory groups and agencies who have requested notice of hearing"; and "other groups and agencies who (by nature of their function, interest or responsibility) the highway department knows or believes might be interested in or affected by the proposal."<sup>19</sup>

The Indiana State Highway Commission follows these requirements by notifying all types of news media - television, radio, major newspapers, local newspapers, bulletin boards and local interest groups. Indiana has developed a special news release (to be published just prior to each hearing) which describes the improvement, includes a map of the improvement, and announces the public hearing. The press has always been very responsive by giving the news releases front page coverage. Since January of 1969 an extensive mailing list has been maintained of those agencies interested or functions affected by a proposal. Since the extensive list has been used, the Indiana State Highway



Commission has found that interested agencies have become more responsive in submitting reviews.

The public hearing notice consists of the date, time and place of the hearing; a description of the proposal; a statement that the environmental impact draft and route location study or design study report, written reviews and comments received from any source, maps and drawings are available for inspection and copying at the district and main office; and request for all parties to present views at the hearing and submit written statements or exhibits. The time and place of the hearing is negotiated with local officials. Since 1970, there has been a tendency to hold public hearings at 7:30 p.m. to allow those who work a chance to attend the hearing; in the past hearings had been held during working hours.

The place for the hearing has always been chosen in the vicinity of the improvement - city hall, school, or other public meeting place. Recent additions to the public hearing notice include the statements that maps, drawings and information developed by the Indiana State Highway Commission and written view of various agencies are available for review and copying at the Indiana State Highway Commission offices or at a location in the vicinity of the project; that tentative schedules for right-of-way acquisition and construction will be described at the public hearing; and that relocation assistance programs will be discussed.

Written statements may be submitted prior to the hearing, during the hearing, or up to two weeks after the hearing for inclusion in the public hearing transcript. For urban projects, Indiana will accept written statements up to four weeks after the date of the hearing. Prior to 1969, written reviews and comments of the various agencies were not included in the transcript, and only material





submitted within ten days after the date of the hearing was included in the transcript.

Immediately prior to the formal hearing, an informal meeting is held to allow the public to familiarize themselves with reports, maps and written reviews, to review the topics and to determine possible speakers and topics for the hearing. At the informal meeting, possible areas of controversy may be discussed with the local officials. Although the informal meeting is not required by any regulation, it has been an established policy of the Indiana State Highway Commission throughout the Interstate Program. In some cases, an informal hearing is held in the afternoon prior to the formal public hearing in the evening. In no instance have two formal hearings been held concerning the same material on the same improvement. However, the Indiana State Highway Commission has a policy of holding hearings over shorter Interstate sections in the urban areas than in the rural areas.

Conduct of Hearing. In Indiana, the Planning Information Manager of the Indiana State Highway Commission moderates public hearings on all highway projects involving State or Federal funds. The public hearing is conducted in the same manner for rural and urban areas. It is a general policy of the Indiana State Highway Commission to have representatives from the district office, the Land Acquisition Division, the Planning Division for a corridor hearing or the Design Division for a design hearing, the Relocation Section, and possibly the design consultant present at the hearings to answer questions. In addition to visual displays used in the hearing presentation, a map of the improvement and a pamphlet describing the Federal-State relationship in the Federal aid highway program is distributed to the members of the audience. The opening remarks by the moderator are an elaboration of the information provided in the pamphlet.



The regulations governing the public hearing process and the process itself are described. The public is informed that the purpose of the public hearing is to keep the public informed of proposed improvements, to allow the public to participate in the consideration of the highway location and design such that the opinions and thinking of the public are considered, to resolve controversial issues that might arise, and to establish the possible social, economic and environmental impacts of the proposal.

Social, economic and environmental effects to be considered during the hearing may include the impact of the improvement on the following: "(1) fast, safe and efficient transportation; (2) national defense; (3) economic activity; (4) employment, (5) recreation and parks; (6) fire protection; (7) aesthetics; (8) public utilities; (9) public health and safety; (10) residential and neighborhood character and location; (11) religious institutions and practices; (12) conduct and financing of Government (including effect on local tax base and social service costs); (13) conservation (including erosion, sedimentation, wildlife and general ecology of the area); (14) natural and historic landmarks; (15) noise, air and water pollution; (16) property values; (17) multiple use of space; (18) replacement housing; (19) education (including description of school district operations); (20) displacement of families and businesses; (21) engineering, right-of-way and construction costs of the project and related facilities; (22) maintenance and operating costs of the project and related facilities; and (23) operation and use of existing highway facilities and other transportation facilities during construction and after completion."<sup>20</sup>

The procedure for submitting written statements is then described. The public is again informed that all reports, maps, reviews and comments are available for





inspection and copying at the central or district office. At present, anything reviewed or produced in regard to the proposed improvement is available prior to and after the hearing for public review. The public is told that the transcripts, with all written reviews and comments attached, are to be thoroughly examined by State and Federal personnel and used as the guides for decisions and for future reference.

At each hearing the moderator, a State highway engineer or consultant describes the alternatives and reasons for selecting the recommended alternative. Emphasis in recent years has been placed on discussing all alternatives in detail. In the past, the recommended alternative was described in detail, and other alternatives were only briefly mentioned. Beginning in the Spring of 1972 the social, economic and environmental consequences of each alternative were summarized.

The State highway department also explains the right-of-way acquisition process, the relocation assistance program and the relocation assistance payments available.

After the State presentation, the audience is encouraged to come forward and speak on the economic, social and environmental affects of the alternatives and present their general views on the alternatives. If no one comes forward to speak on these effects, the summary of the public hearing would state that no one came forward to speak on these effects, and that there was no opposition to the proposed route on this basis.

After the formal public hearing, it is an Indiana policy to hold an informal hearing to discuss personal problems and to consider areas of controversy and possible action with public officials.





The news media generally gives front page coverage to the public hearing proceedings. The news review generally covers the reasons that the recommended alternative was selected over the other alternatives, the cost of the recommended alternative, areas of controversy and views of various interest groups, and supporters and opponents to the recommended alternative.

Action on Transcript. The Planning Information Manager insures that action is taken on the public recommendations and suggestions by summarizing the hearing (numbers of speakers, areas of controversy, and possible resolution of controversy or action to reduce controversy); including all statements before, during and after the date of the hearing with the verbatim transcript; and forwarding the summary, transcript and statements to the Executive Director, Planning Division or Design Division of the Indiana State Highway Commission for review and action. Since January of 1969, Federal regulations have required the State highway departments to consider the social, economic and environmental effects of the proposal before submission of a request to the Federal Highway Administration for location or design proposal approval. The consideration of social, economic and environmental effects must include "an analysis of information submitted to the State highway department in connection with public hearings or in response to the notice of the location or design for which a State highway department intends to request approval" and "information developed by the State highway department or gained from other contacts with interested persons or groups."<sup>21</sup> However, the Planning Division and Design Division have always been required by Indiana State Highway Commission policy to evaluate the recommendations and areas of controversy that come to light in the public hearing. These Divisions have been in constant contact with local officials since the



inception of the project to resolve problems that arise and to determine the desires of the locality. Appropriately, the recommendations and areas of controversy are discussed with the local officials and a probable course of action determined. Also, recommendations by the public or officials that come before or after the public hearing are routed to the appropriate Division who acknowledges receipt of the recommendations, takes action on the recommendations and informs the public and officials of the actions taken. The environmental impact statement is finalized at this stage if it is still pending.

After all comments to be included in the transcript have been received and appropriate action has been taken on the hearing recommendations, the Executive Director signs the certification that a public hearing has been held or offered and the certification that the social, economic and environmental effects of the highway improvement have been considered. The verbatim transcript with all statements attached, the summary of the transcript, the certification of socioeconomic-environmental evaluation, statements and reviews on the improvement by various agencies, the route or design study, and list of information made available to the public at the hearing are sent to the FHWA Division Engineer with a request for route or design approval. A listing of information made available to the public has been required since January of 1969.

Notice of Request for Approval. Upon submission of the request for Federal approval, the State publishes a "legal notice of request for Federal concurrence in proposed state route improvement" in a newspaper having general circulation in the area of the improvement and a newspaper having substantial circulation in the area of the improvement. Other news media also receive the notice.





The notice contains a description of the location or design proposed, a map of the proposal, the statement that the proposal is being submitted for approval by the Federal Highway Administration, and the statement that all materials submitted in support of the request and the draft environmental impact declaration are available for inspection and copying at the main and district offices. Prior to January of 1969 when the new policy and procedure memorandum on hearings was published, the notice of request of approval was not a regulation, and the news media were not always informed.

The Federal Highway Administration reviews the request with the accompanying material to determine if the hearing regulations have been fulfilled. The FHWA may approve the request with or without comment, or delay approval of the request until appropriate action has been taken on the public recommendations of the hearing or the areas of controversy have been resolved.

**Notice of Project Approval.** Upon Federal approval of the improvement, the State publishes a "legal notice of intention of proposed state route improvement" in newspapers in the vicinity of the improvement. The notice states that the proposal has been approved by the FHWA; describes the improvement; includes a map of the improvement; and again states that the environmental impact statement, plans, route location or design study report, and written views and comments received from any source relative to the project are available for inspection and copying.

Public pressure has been responsible for many changes in the public hearing procedures, particularly the emphasis on the environment. Although many of the changes have been of Federal origin, the Indiana State Highway Commission has also altered policy during the life of the Interstate Program in the desire to be more responsive to public recommendations, to maintain a closer relationship with the



public, and to better resolve areas of controversy. All but a few of the public hearings for the Interstate System preceded the changes in the public hearing process resulting from the revised Federal policy and procedure memorandum of January, 1969. Nevertheless, every Interstate project was revised to some degree by the recommendations that came to light prior to or during public hearings. A majority of the revisions were relative to access and egress, fencing and other access features such as frontage roads, access roads, and the linking of closed county roads. Public recommendations have to a certain degree been responsible for altering the corridors of Interstate Routes in the case of Interstates 64 and 69.

The public now has a greater opportunity to recommend alternatives, to select alternatives other than the alternative preferred by the State, and even to kill projects.

A major innovation in public relations initiated by the Indiana State Highway Commission involved Interstate 164 near Evansville. During the preliminary planning process for Interstate 164, the public had been requested through various news media (television, radio, and paper) to submit recommendations for alternate routes.

Other Changes in the Review Process. For many years the State highway department and the division office of the Bureau of Public Roads were the only project review agencies. With the advent of the Interstate Program, several review functions were moved from the division office of the Bureau of Public Roads to the regional or Washington office. Nevertheless, the bulk of the review was done between the State highway department and the division office of the Bureau of Public Roads except for the formality of the Governor's approval of the final route location. As previously stated, the public hearing became mandatory in 1956; however, the hearing was more of an information producing mechanism than a review mechanism. As transportation





problems and improvement coordination became more complex and as the public demanded the consideration of a wider range of consequences of transportation improvement, new laws and regulations involved more agencies in the transportation planning and review process.

The Federal Aid Highway Act of 1962 required a comprehensive and continuing transportation planning process in urban areas of 50,000 population or more for continued Federal participation in urban projects. The comprehensive component of the transportation planning process required that economic, population and land use factors be included in the inventories and analyses; that future demand for all modes of transportation both public and private for goods and people be estimated; that terminal facilities and traffic control systems be included in the inventories and analyses; and that the entire metropolitan area be included in the process. The continuing component of the transportation planning process required that all data inventoried must be continually updated and that the transportation plan be continually updated and reevaluated. To organize and undertake a metropolitan area comprehensive transportation planning program, the participation of agencies over the entire metropolitan area was needed. This entailed the formation of a permanent mechanism to coordinate the agencies. The mechanism in most cases consisted of three interrelated coordinating committees: a policy committee composed of the elected officials of the jurisdictions involved and of representatives from the State highway department and the division office of the Bureau of Public Roads; a technical committee composed of representatives from the highway, public works and planning agencies of the jurisdictions involved and of technical representatives of the State highway department and the Bureau of Public Roads; and a citizen's advisory committee appointed by the local government to insure citizen participation in the planning process.





Coordinating committees were not necessarily a new phenomenon in 1962. Urban areas which had done transportation planning in the 1950's had established coordinating committees. In Indiana, the Tri-State Highway coordinating committee involving highway officials from Wisconsin, Illinois, Indiana, Chicago and Cook County preceded the Second World War although it has long since been dissolved. Most of the metropolitan areas in Indiana have had established transportation coordinating committees since the Interstate Program began. Numerous transportation coordinating committees of regional and interstate character have been formed since 1962.

The detailed review of capital improvement programs began with the passage of The Demonstration Cities and Metropolitan Development Act of 1966. Section 204 of this act required the submission of all applications "for Federal loans or grants to assist in carrying out open-space land projects or for planning or construction of hospitals, airports, libraries, water supply and distribution facilities, sewage facilities and waste treatment works, highways, transportation facilities, law enforcement facilities, and water development and land conservation projects within any metropolitan area" to an areawide agency for review.<sup>22</sup> The areawide review agency is an agency empowered to perform metropolitan or regional planning in the area involved and is designated to perform the review by the Department of Housing and Urban Development or State Governor.<sup>23</sup> The State highway department was required to submit Federal aid highway proposals involving the preparation of construction plans or acquisition of right-of-way in a metropolitan area to the areawide review agency for review. Projects, which were a part of staged construction previously approved or for which a substantial part of the right-of-way had been acquired as of June 30, 1967, were excused from review.



In Indiana, several sections of the Interstate System in the Indianapolis Metropolitan area were subject to "Section 204 Review". The areawide agency commented on the consistency of the project with comprehensive planning (developed or in the process of development for the metropolitan area) and on the extent to which the project contributed to the fulfillment of such planning. After comments and recommendations were received from the areawide review agency or the application had lain before the areawide review agency for sixty days without comments or recommendations, the State highway department forwarded the project application and a report on the disposition or non-acceptance of each comment or recommendation to the Division Engineer of the Federal Highway Administration for review and approval. If the disposition of comments or recommendations was considered appropriate by the Division Engineer, he would then approve the location, right-of-way acquisition, or construction plans for the project.

The Intergovernmental Cooperation Act of 1968 expanded the scope of review to encompass all Federal programs or projects regardless of whether or not the project was in a metropolitan area. Title IV of this act directed the President to "establish rules and regulations governing the formulation, evaluation, and review of Federal programs having a significant impact on area and community development."<sup>24</sup> The general objectives of the act focus on the importance of sound and orderly development of urban and rural areas to the economic and social development of the Nation and the achievement of satisfactory levels of living. National, regional, State and local objectives were to be considered in plan formulation, evaluation and review of Federal or federally assisted development programs and projects. Moreover, the projects were to be consistent with national, State, regional and local planning objectives. The President authorized the Bureau of Budget, now the





Office of Management and Budget, to develop and promulgate rules and regulations consistent with this act. On July 24, 1969 the rules and regulations of the review process were published in the Bureau of Budget Circular Number A-95 from which the "A-95 Review Process" received its name.

Considerations in the general review process have changed considerably over time. The environmental impact statement requirement was an outgrowth of section 102 (2) of the National Environmental Policy Act of 1969. Section 4(f) of the Department of Transportation Act required a special environmental statement when a project involved the use of publicly owned land from a park, recreation area, or wildlife and waterfowl refuge of national, State or local significance. Section 309 of the Clean Air Act of 1970 required an evaluation of projects in regard to compatibility with air quality control standards. The Federal Aid Highway Act of 1970 required the Secretary to establish and promulgate standards for highway noise levels compatible with different land uses and guidelines to assure that possible adverse economic, social and environmental effects of any Federal aid system project had been considered in developing the project and making the final decision.

A-95 Review - Project Notification and Review System. The initial Bureau of Budget Circular A-95 was a means of implementing section 204 of The Demonstration Cities and Metropolitan Development Act of 1966 and Title IV of the Intergovernmental Cooperation Act of 1968. The revised Circular A-95 of February 9, 1971 expanded the programs covered and assisted the National Environmental Policy Act of 1969. The circular encourages the establishment of the "project notification and review system"; establishes a means to coordinate Federal development programs with State, regional, and local planning and programs; and establishes a means to coordinate State plans with Federal planning

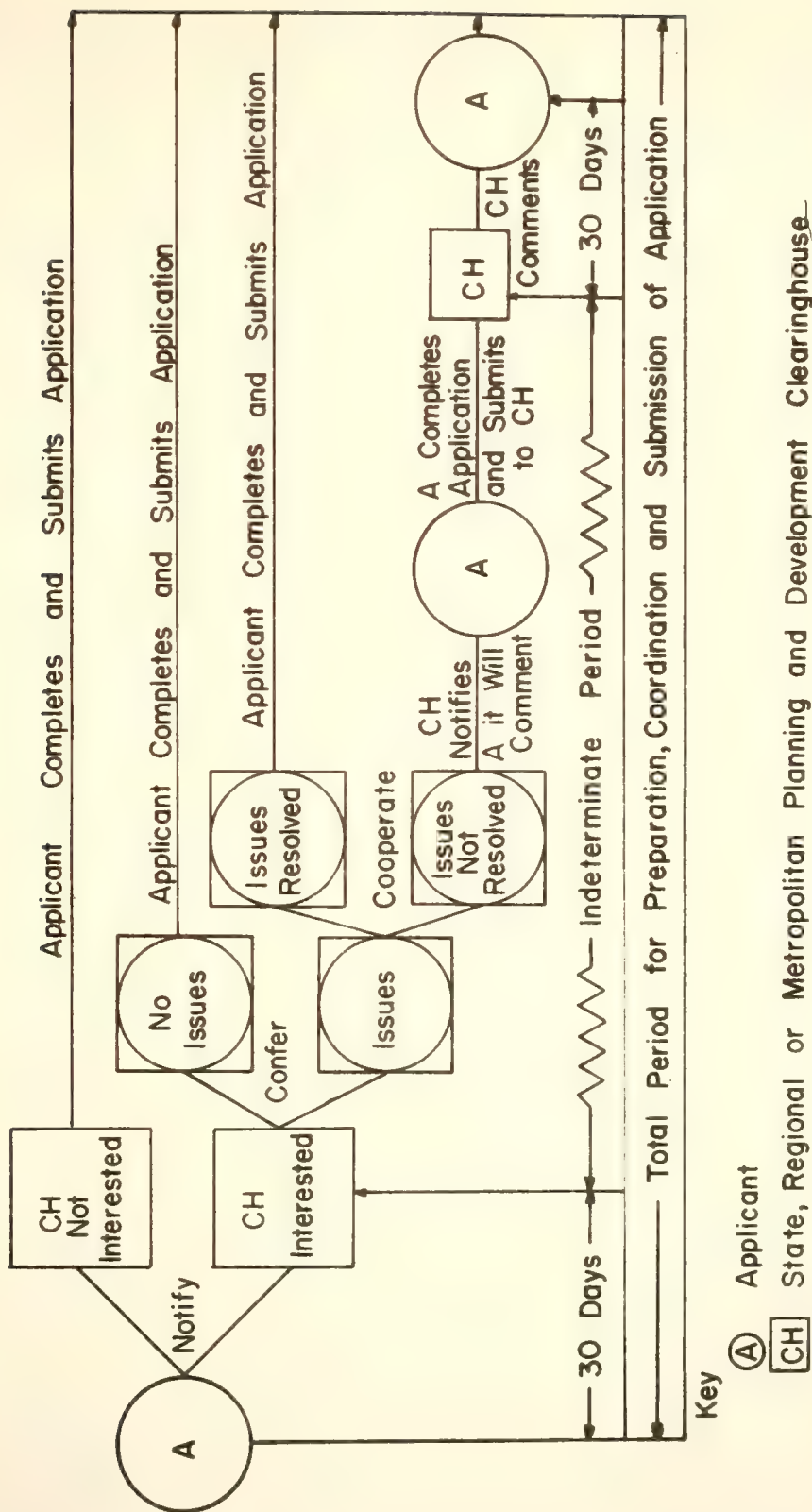


and programs. The last purpose has been amplified by the Bureau of Budget Circular Number A-98 which encouraged the designation of a State central information reception agency to serve as the central reception point in the State for information on Federal grant-in-aid actions as required by section 201 of the Intergovernmental Cooperation Act of 1968.

The "project notification and review system" is intended to (1) implement "the policies and directives of Title IV of the Intergovernmental Cooperation Act of 1968 by encouraging the establishment of a network of State, regional, and metropolitan planning and development clearing-houses which will aid in the coordination of Federal or federally assisted projects and programs with State, regional, and local planning for orderly growth and development; (2) implement the requirements of section 204 of the Demonstration Cities and Metropolitan Development Act of 1968 for metropolitan areas within that network; (3) implement in part, requirements of section 102(2)(c) of the National Environmental Policy Act of 1969, which require State and local views of the environmental impact of Federal or federally assisted projects; and (4) encourage, by means of early contact between applicants for Federal assistance and State and local governments and agencies, an expeditious process of intergovernmental coordination and review of proposed projects."<sup>25</sup> All Federal aid projects authorized after September 30, 1969 were subject to A-95 review. Projects, which were a part of staged construction already approved or for which a substantial portion of right-of-way had been purchased, were exempted from A-95 review.

Referring to Figure 13 (p. 163), the process begins when the State highway department desiring Federal assistance makes inquiries of the Federal Highway Administration, and the Federal Highway informs the State highway department that the project is subject to A-95 review. At least thirty days prior to the preparation of the formal



FIGURE 13. PROJECT NOTIFICATION AND REVIEW SYSTEM<sup>26</sup>





application to the Federal Highway Administration, the State highway department is required to notify both the State clearinghouse and the regional clearinghouse, if one exists, or the metropolitan clearinghouse in which the project is located of their intent to apply for assistance. The summary notification includes a description of the project and a brief statement of whether or not an environmental impact statement is required.

Within five days, the State clearinghouse notifies the State highway department and the appropriate regional or metropolitan clearinghouse of the receipt of the summary notification. Within the same time span, the State clearinghouse forwards a copy of the summary notification to State, interstate or interregional agencies (whose function might be affected by the proposed project or who develop or enforce environmental standards) with a request for review and reply within fifteen days. Concurrently, the State clearinghouse evaluates the consistency of the project with statewide comprehensive planning and State programs and the extent to which the project contributes to the realization of State goals and objectives. Within fifteen days, the State clearinghouse receives replies from the referral agencies indicating their interest in the project, stating possible areas of conflict with their plans and regulations, and offering comments on the environmental significance of the project. Within a period of thirty days (originally sixty days under section 204 review) after the receipt of the project notification, the State clearinghouse must inform the State highway department (1) "That the review procedure has been completed, that there is no apparent conflict with State plans, goals and objectives and no need for further discussions, and that the applicant may complete and file the formal application with appropriate federal agencies"; or (2) "that there is a State interest in the proposed project, and that one or more of the reviewing



agencies has raised questions, pointed out conflicts or commented critically and wishes to confer with the applicant."<sup>27</sup>

The regional or metropolitan clearinghouse follows the same procedure as the State clearinghouse except that local governmental agencies are notified and the project is evaluated on the basis of compatibility with regional, metropolitan or local comprehensive plans, programs and objectives.

If an agency takes interest in the project, the clearinghouse (in coordination with other clearinghouses) arranges conferences or initiates correspondence between the interested parties and State highway department to explore the project in greater detail, to identify possible conflicts or mutuality of interest and to resolve questions or conflicts. If continuing interest persists, the State highway department and clearinghouse cooperate to resolve the conflicts. Based on the results of the conferences and mediation efforts, the clearinghouse notifies the State highway department that the conflicts have been resolved, the project is now in accordance with referral agency plans and objectives and the State highway department may complete and file the formal application; or that the conflicts have not been resolved, the project is in conflict with referral agency plans and objectives and the clearinghouse intends to comment adversely on the final application unless the project is revised.

The State highway department may request Federal Highway Administration approval of studies that may assist in resolving such issues. After completion of such studies, the State highway department resubmits the project to the clearinghouse for further review and comment.

If the clearinghouse intends to comment, it has an additional thirty days after receipt of the final application, revised or unrevised, to review the application





and to make comments and recommendations. The clearinghouse submits any formal comments of its own or of a referral agency to the State highway department.

The State highway department submits the application to the Federal Highway Administration with the comments of the review agency, if any. If there were no comments, a statement that the notification requirement was met must accompany the application. The Federal Highway Administration reviews the application and the comments of the review agency, if any, and informs the clearinghouse within seven days of the action taken. The Federal Highway Administration may approve the application with or without comment or return the application for amendment.

All highway planning programs and all highway improvement programs are subject to A-95 review. At the time of location approval, the State highway department must submit evidence that the project was previously submitted to the clearinghouse at the program stage. The Division Engineer is required to provide the clearinghouse with a copy of the letter to the State highway department concerning the actions taken by the FHWA on the proposed locations which have been reviewed by the affected clearinghouse. When locations which have been adversely commented on by an affected clearinghouse are approved, the Division Engineer is required to forward the letter of location approval accompanied by the clearinghouse comments to the FHWA regional and Washington offices. At the location stage, the clearinghouse may request the opportunity for additional review at the design stage. If such a request was made, the State highway department must submit at the time of design approval a copy of the clearinghouse's comments and recommendations accompanied by a statement on the disposition of each comment or recommendation and, if applicable, reasons for nonacceptance of the comments or recommendations.



The project notification and review system has been successful in coordinating the reviews of various agencies such that the possible economic, social and environmental consequences, the interactions of considerations, and the trade-offs between and within the highway, user, and non-user components of highway projects have been evaluated and taken into consideration in the decision-making process.

### Design

This subchapter covers design criteria, its evolution, and its effect on Indiana policies and the Interstate Program. Special emphasis is placed on the philosophy, practice and history of design in Indiana.

#### Evolution of Design Standards

During the life of the Interstate Program, Interstate design standards have changed drastically. Although these changes have escalated the ultimate cost of the Interstate System, the facilities constructed provide better and safer service.

Early in the Interstate Program, Indiana had little experience in designing freeways, particularly in urban areas. Design changes were really an evolution in knowledge on the part of the highway engineer and the public. At the beginning of the Interstate Program, little experience existed in the design of pavements for heavy axle loads, acceleration and deceleration lanes, weaving and auxiliary lanes, and slopes; in the capacities and operating characteristics of freeways; and in the selection, location, spacing and operating characteristics of interchanges. The lack of public knowledge of benefits to the user and the community from freeways resulted in public skepticism of the necessity for costly freeway designs and was translated into severe monetary constraints on





freeway design by Congress. When the public recognized the necessity for higher design standards for safety reasons alone and reduced the monetary constraints on design, the State highway departments were forced to rebuild certain design elements of the Interstate to standards that the State highway department had advocated for years but could not implement because of monetary constraints.

Changes in design criteria were not necessarily a delaying factor in the overall Interstate Program. However, the upgrading of the design criteria increased the ultimate cost of the Interstate Program; and the failure of Congressional apportionments to keep pace with the rising costs resulted in delaying the completion of the System. In the last years of the Interstate Program, there has been a slow down in Interstate construction because of the limited Interstate funds available in any quarter of the fiscal year.

Changes in the design process were due primarily to Federal legislation and the regulations promulgated by the Bureau of Public Roads. Although the Interstate Program did not inherently require these changes, the Interstate Program, as the predominant highway program of the era, was the source of experience in those changes.

The two hearing requirement as of January of 1969, the A-95 review requirement as of July of 1969 and the environmental impact statement requirement as of January of 1970 produced the most recent changes in the design process. A general overview of the design process as of 1972 shows how these changes have been incorporated into the process. Referring to Figure 14 (p. 169), the design process consists of the following generalized stages:

- (1) The design consultant and his fee are approved in the consultant agreement. The scope of the project and preliminary project cost estimates are approved by the FHWA at this time.





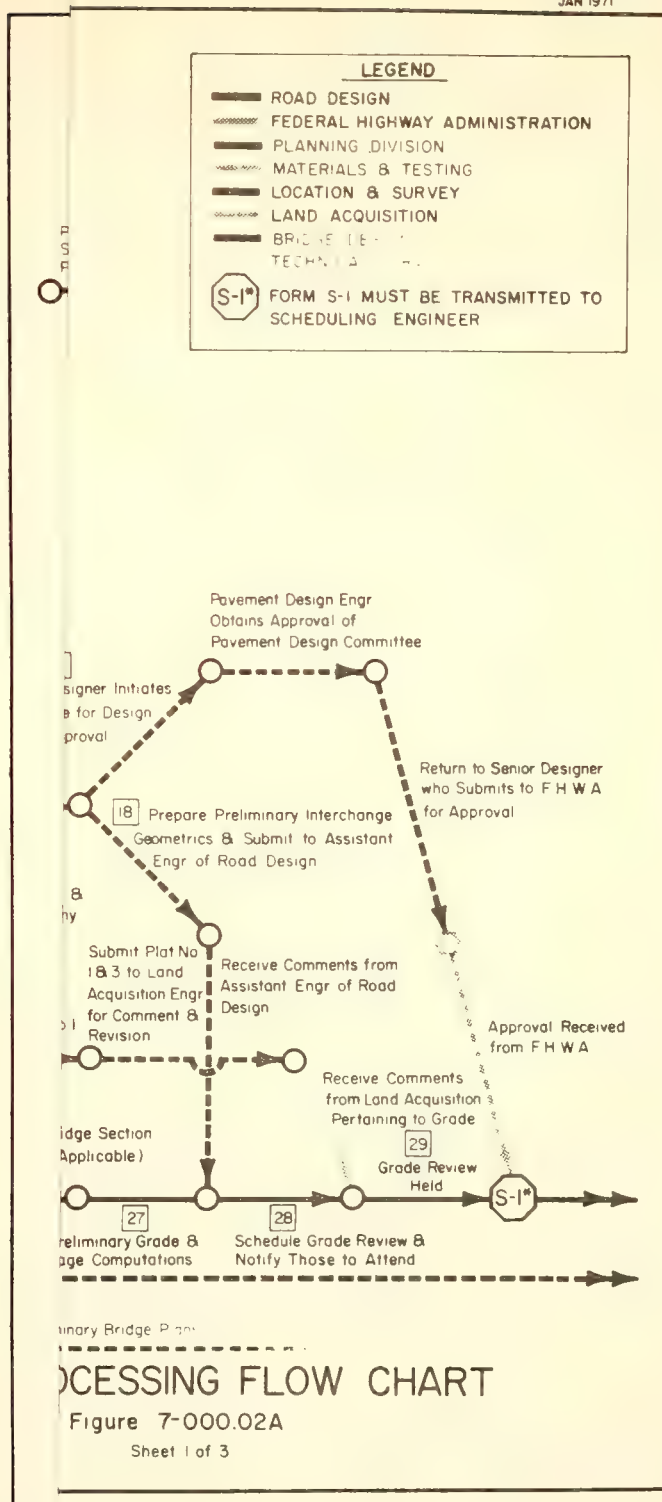


FIGURE 14. DESIGN PROCESS



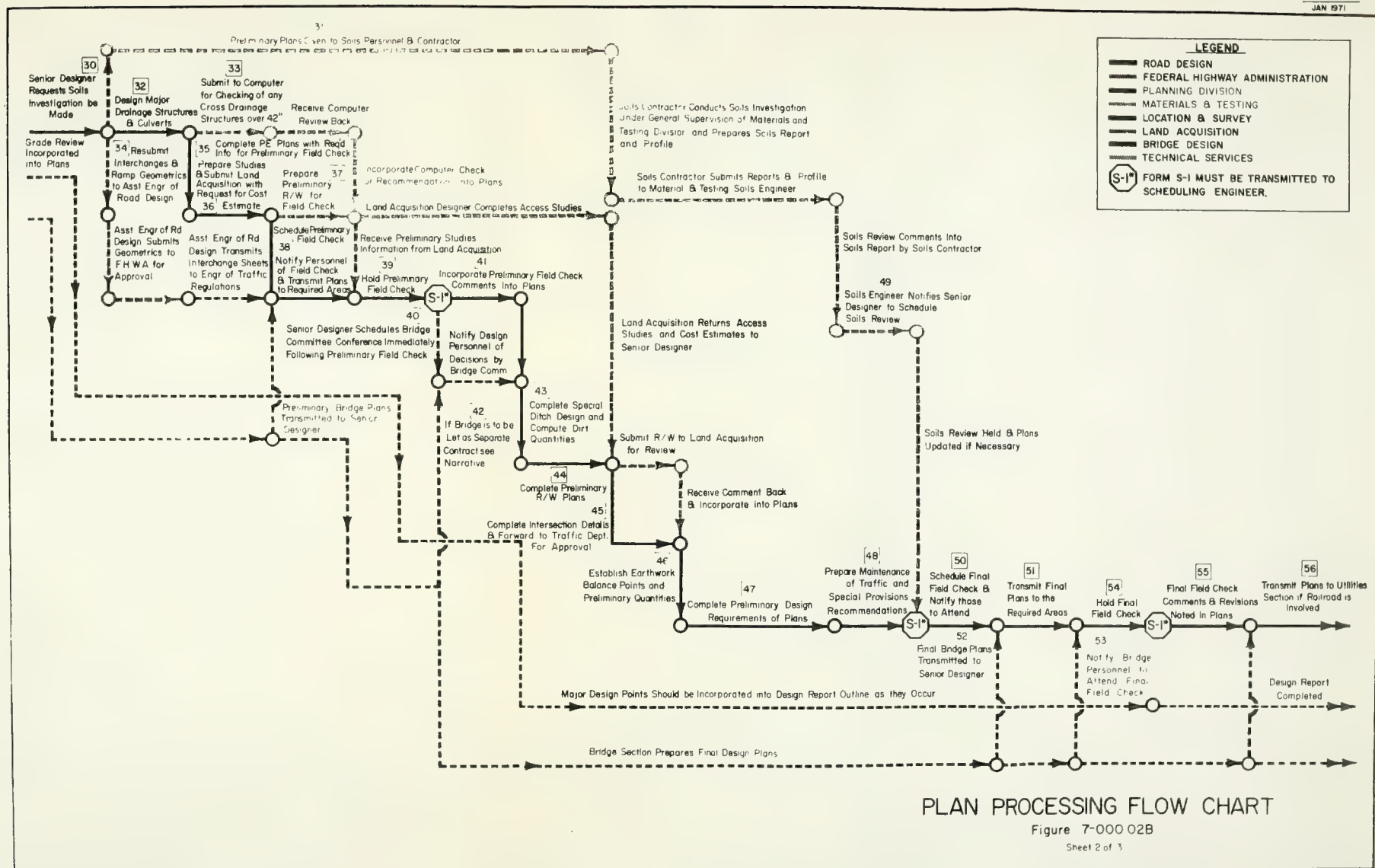














Sub  
to C  
Draw  
Boa  
  
C  
Desi  
Tran  
Plan  
Mar

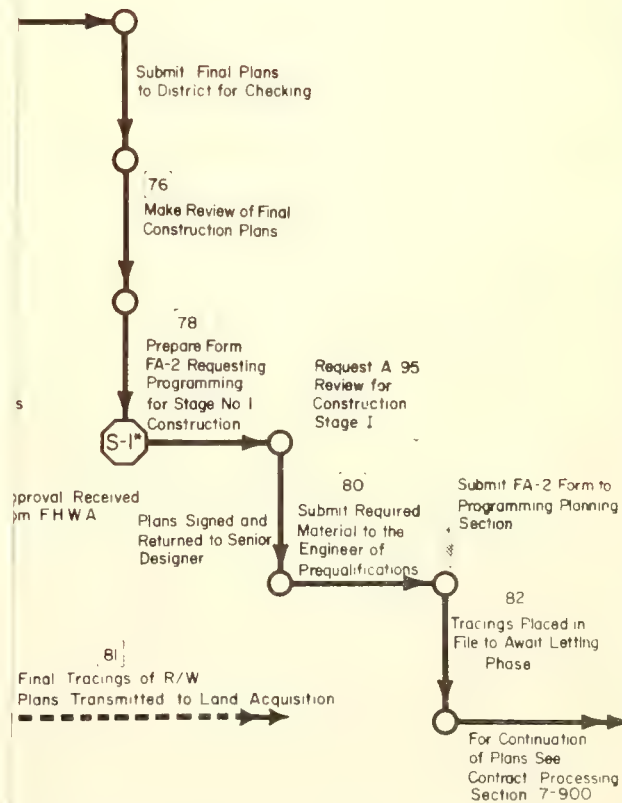
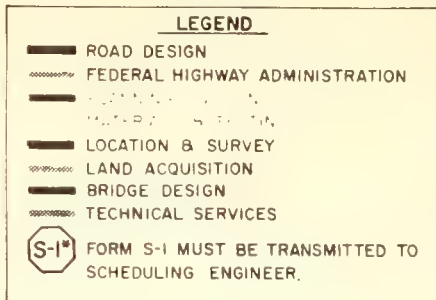


FIGURE 14, CONT.





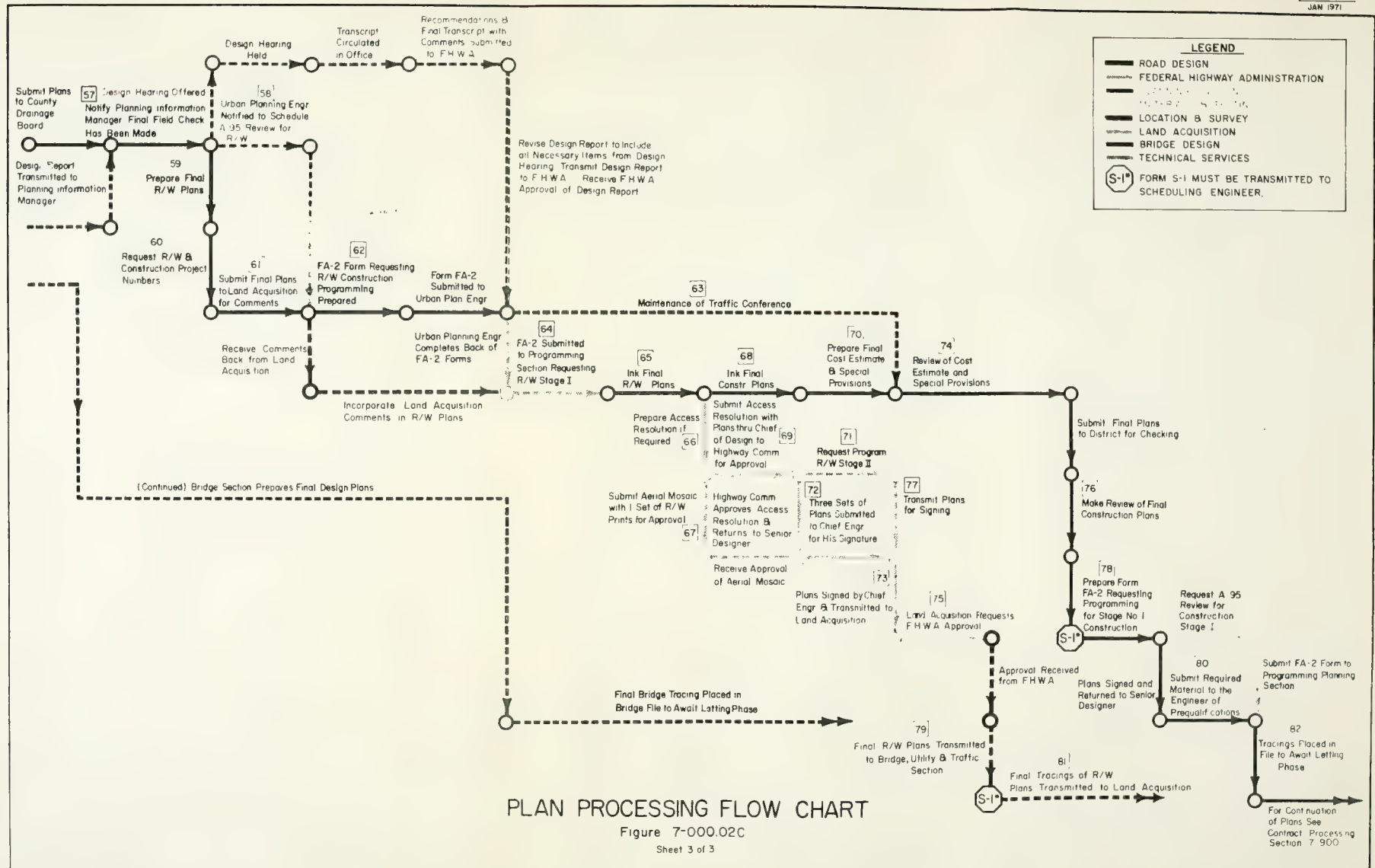


FIGURE 14, CONT.



- (2) After the location studies, the access control studies and environmental impact reports are prepared by the Planning Division or their consultant, the corridor public hearing and the A-95 review are held for the project. Right-of-way encroachment field reviews are conducted concurrently.
- (3) The corridor hearing transcript with recommendations, the transcript and comments of the A-95 review, the environmental impact statement which may have already been approved previously by the FHWA, the location study, and the encroachment list are forwarded to the FHWA with a request for location approval.
- (4) Upon FHWA approval of the project location, preliminary engineering begins.
- (5) After the survey, plot of cross sections and continuous profile, pavement design and preliminary interchange geometrics are completed, the preliminary grade and drainage are developed and scheduled for review.
- (6) A grade review is held with the FHWA participating and the grade review is incorporated into the plans.
- (7) The design of major drainage structures and the soil investigation begins, and the interchange and ramp geometrics are submitted to the FHWA for approval.
- (8) After right-of-way studies and costs are estimated, a preliminary field check is held with the FHWA participation.
- (9) The preliminary field check is incorporated into the plans.





- (10) After the earthwork quantity estimates, preliminary right-of-way plans and preliminary design requirements are completed, the final field check is held with the FHWA participating.
- (11) After the access control is reworked and the design study is completed, the design hearing and A-95 review are scheduled. Since the effect on the property owners and the amount of land needed for the project must be known at the time of the design hearing, the general design must be completed to the extent that the property to be acquired can be legally defined. At this stage the general design is sixty-five to seventy percent complete. The preliminary geometrics approved by the FHWA prior to the design hearing are thirty to thirty-five percent complete. [Prior to the two hearing requirement, all preliminary engineering, design and right-of-way plans were completed after the single public hearing required for location approval.]
- (12) After the design hearing and the A-95 review, the design report is revised, and the environmental statement is finalized. The transcript with comments from the design hearing and A-95 review, the revised design report and the environmental statement are forwarded to the FHWA with a request for design approval.
- (13) Upon receipt of design approval, the design and right-of-way plans are finalized. The access control resolution and plans are approved by the ISHC.
- (14) The final plans, specifications and estimates are forwarded to the FHWA who authorizes land acquisition and the letting of the contract.



- (15) Prior to the letting of the construction contract the project may again be subject to A-95 review.

Over the life of the Interstate Program, the FHWA regulations have required more detailed documentation and justification of designs. Economic analyses and traffic analyses are required to provide documentation and justification for all major design decisions made for all Federal aid highway projects.

Influence of Forerunners on Interstate Design. The concept of a network of superhighways was first implemented in Germany with the construction of a national system of autobahns in the 1930's. 5000 miles of dual-lane autobahns with medians and access control were built in a six- to seven-year period. The American Association of State Highway Officials (AASHO) recognized this new concept of design before the Second World War. Indiana utilized the concept to design the Tri-State Highway prior to the outbreak of the War. The construction of the Tri-State Highway between 1949 and 1952 preceded the design of the Indiana Toll Road in 1953 and 1954 and construction of the Indiana Toll Road in 1956 and 1957.

AASHO design standards and research strongly influenced the Indiana Toll Road design. Since construction of the Indiana Toll Road, the Indiana State Highway Commission has opposed the use of the median for service facilities and rest areas, even when the directional lanes were separated by large distances, because of left hand entrances and exits. The use of the median for service facilities was intended to hold down right-of-way costs. Nevertheless, Indiana put its service facilities on the outside even though additional right-of-way had to be purchased.

Other early four-lane divided highways included US 24 between Ft. Wayne and Huntington and US 52 from Lebanon to Lafayette. These highways had only thirty-foot medians. As truck lengths grew, these medians were no longer wide enough to shadow the truck.



There is general belief in Indiana that the concept of merging lanes was developed at the Indianapolis Speedway.

The Madison Avenue Expressway in Indianapolis and the Tri-State Highway in Hammond were the only urban expressways built prior to the Interstate Program of 1956. The Madison Avenue Expressway emphasized the difficulty of depressing facilities in an area where many sewers and a water table problem exist. Because of the water table, the expressway could not be depressed as deeply as originally planned; this necessitated the raising of all crossroads at considerable expense.

The early bypasses of Kokomo, Lafayette, Marion and Shadeland Avenue in Indianapolis deteriorated from bypasses which served only through traffic to roads that serve both through traffic and provide access to considerable development. These bypasses, which were intended to separate through and local traffic and to relieve congestion on local streets by removing through traffic, only shifted congestion. These early bypasses emphasized the need for limited or full access control to protect the original function of the highway.

The first interchange in Indiana was built at the intersection of SR 49 with US 12 and 20 in the 1930's, but it lacked one-way ramps and was really a traffic circle. Other interchanges of a similar nature were built at other intersections along US 12 and 20 in the Calumet area. The first true interchange with one-way ramps were built on the Tri-State highway between 1949 and 1952. These interchanges of cloverleaf design are still in use with minor modifications. In 1954, a cloverleaf interchange was built at the intersection of US 30 with US24 on the Ft. Wayne north and east bypass; however, the interchange lacked the acceleration and deceleration lanes which are considered a necessity by current design standards. A cloverleaf interchange was also built at Washington Street (US 40) and Shadeland Avenue





(SR 100 bypass) in Indianapolis in 1955. This interchange lacked sufficient capacity for Interstate traffic when SR 100 was considered as a possible location for Interstate 465 East. Although knowledge of the operating characteristics of interchanges was gained from these early interchanges, much of the interchange design experience came during the Interstate Program.

The Indiana State Highway Commission gained much from the knowledge of the operating characteristics and deficiencies of previously built dual-lane highways and bypasses. However, it must be recognized that economics, not the desires of the design engineers, dictated the design of these predecessors of the 1956 Interstate Program. Nevertheless, the overall picture is one of a gradual evolution in design standards to meet the rising expectations of the public, from knowledge of the operating characteristics of previous designs and knowledge developed through research and experience.

Interstate Design Standards. In accordance with section 108(i) of the Federal Aid Highway Act of 1956, the design standards for the National System of Interstate and Defense Highways (adopted by the AASHO on July 12, 1956) were approved by the Bureau of Public Roads Commissioner on July 17, 1956. The design features of the System were to be adequate to accommodate the traffic of 1975; however stage construction of a section could be justified. All intersecting highways and railroad crossings were to be grade separated; however, at grade intersections might be permitted in sparsely settled rural areas of the West under specific conditions. The minimum design speed for flat terrain was 70 mph in rural and suburban areas and 50 mph in urban areas. The lower design speed in urban areas allowed more capacity per lane and closer interchange spacing and results in lower right-of-way requirements. The



maximum ramp grade was three percent in rural areas, but sometimes went to a maximum of five percent in urban areas. The minimum ramp speed was between 30 to 35 mph in rural areas and might drop as low as 15 mph in rare instances in urban areas. The minimum ramp radii used was 208 feet. The maximum degree of curvature on the through lanes was three degrees in rural areas; however, Indiana used a maximum curve of two and a half (2-1/2) degrees for the Interstate System. The maximum grade was three percent in flat rural areas and increased to five percent in mountainous terrain. When variable median design was used, a maximum four percent downgrade was acceptable. Two-lane highways were acceptable only when the design hour volume fell below 700. Travel lanes were twelve feet wide with eleven-foot shoulders. Side slopes of four to one or flatter were acceptable. There were no minimum right-of-way widths. Only bridges less than 150 feet long were to be designed to carry the full width of the roadway and shoulders.

Since these AASHO design standards were adopted for the Interstate System in 1956, there has been a drastic change in the standards over the life of the Interstate Program.

Change in the Design Year. When Interstate Highway legislation was first introduced to Congress in 1955, the design year of 1975 was consistent with the accepted policy of designing highways for the traffic of twenty years in the future. The study A 10-Year National Highway Program of 1955 recommended upgrading of the Interstate System over a ten-year period (1955 to 1964) to a level of adequacy for the traffic predicted for 1974. The President's Advisory Committee on a National Highway Program realized their recommendation meant that improvements in the latter part of the ten-year program would have less than a twenty year design life although not less than a ten year design life. Congress stretched the Interstate Program out to





thirteen years when the legislation was passed in 1956 and retained the design year of 1975 which had been introduced in the original legislation of 1955. Consequently, if the System had been completed in 1969 as scheduled, the minimum design life for an improvement would have been seven years.

As the funding apportionments fell behind the increasing cost to complete the System, it became obvious that the Interstate Program would have to be stretched out further to stay within the expected revenues. After several years of pressure on Congress, the Bureau of Public Roads in conjunction with the AASHO and State highway departments convinced Congress that the most important highway system in the nation should be built with a design life at least comparable to that of other highways being built. The Federal Aid Highway Act of 1963 changed the design year for the Interstate System from geometric and construction standards adequate for the types and traffic volumes forecast for 1975 to geometric and construction standards adequate for the types and traffic anticipated for the twenty year period after the plans, specifications and estimates for the project were approved. Initial construction authorized before October 24, 1963 used the 1975 design year, and initial construction on or after October 24, 1963 used a design twenty years from the date of initial construction approval.

Minimum Four-Lane Requirement. When Congress began to advocate highway safety and recognized the fact that accident rates were lower for four-lane divided highways than two-lane highways, it included a provision in the Federal Aid Highway Act of 1966 that required a minimum of four lanes for the Interstate System. At the time the provision was passed, sixteen States including Indiana had segments of the Interstate System where traffic volumes for the design year justified only two lanes. Since the



interregional highway study of 1944, much of Interstate 64 across southern Indiana had been anticipated to require only two lanes; by 1966, only a few segments would have been constructed as two lanes based on the adequacy for traffic twenty years hence. It did not matter after 1966 if the two-lane segments were completed, under construction, under design, or under preliminary investigation; all two-lane Interstate highways were to be modified to four lanes.

Evolution of Pavement Design. Early in the Interstate Program, State highway departments including Indiana used a rough guide to select the type and thickness of pavement for the Interstate projects. If the traffic volume per day was under 5000, Indiana selected eight-inch concrete pavement; if the volume per day was between 5000 and 10,000, nine-inch concrete pavement was selected; and if the volume per day was greater than 10,000, ten-inch pavement was selected. As a result of the knowledge of pavement design criteria gained through the AASHO Road Test and the development of more sophisticated pavement equations, the State highway departments were later required by the Bureau of Public Roads to conduct a pavement structural design analysis, traffic analysis and loading analysis to justify the pavement design for any federally funded project. By 1967 even more reliable data on traffic volumes and axle load frequencies and improved methods for forecasting future trends had been developed.

With this new knowledge, it was evident in 1967 that many of the Interstate pavements authorized for construction prior to October 24, 1963, would not last through their intended design life. To correct this problem, the Bureau of Public Roads clarified their policy to allow Federal Aid Interstate fund participation in the cost of an additional stage of pavement construction when existing pavement was structurally inadequate or would not provide reasonable service with normal maintenance to the design year.





Since many of the pavements authorized for construction prior to October 24, 1963 with Federal Aid Interstate funds were not specifically identified as being an initial stage of pavement construction, the omission of such identification was considered an oversight (because the procedures for stage construction were not distributed until January 11, 1962) or "a misjudgement of forecasts of traffic and of adequacy of the designs."<sup>29</sup> Thus, all pavements constructed prior to October 24, 1963 were reevaluated and, if necessary, a further stage of pavement construction was authorized under the Interstate program whether or not the construction in place had been identified as an initial stage of the ultimate stage of development.<sup>30</sup>

This 1967 policy on staged construction altered the original policy of January 11, 1962, which prohibited further Federal Aid Interstate fund participation in the reconstruction or improvement of pavements that had been constructed to the ultimate design for 1975 traffic needs. The 1962 policy allowed Federal Aid Interstate participation in an additional layer of pavement only for projects which were constructed prior to the adoption of the 1956 Interstate standards and had inadequate pavement to accommodate 1975 traffic or which were designated for staged pavement construction at the time of initial construction.

The effect of the new policy was to make all segments of the Interstate System adequate for the traffic of twenty years from the date initial construction was authorized. If the initial pavement construction authorized prior to October 24, 1963 for Federal Aid Interstate fund participation was determined to be structurally inadequate for the appropriate design year by the field examination and structural analysis, an additional stage of construction to provide adequacy through the appropriate design year was eligible for Federal Aid Interstate fund participation.





"The design traffic analysis period for determining the ultimate design (was) to be twenty years after the date of authorization of the initial pavement construction project, with a design year of 1975 for work authorized in mid-1956 and a design year of 1983 for work authorized in late 1963."<sup>31</sup>

Normal maintenance, however, was excluded from Federal aid fund participation. If the existing pavement structure needed reconstruction to render it structurally sound as an element of the ultimate design, the work was not eligible for Federal Aid Interstate fund participation but might be approved for Federal Aid Primary or Federal Aid Urban fund participation. [Refer to Figure 15, p. 182].

If the initial pavement construction was authorized prior to October 24, 1963 with other than Federal Aid Interstate funds, was accepted into the Interstate System as reasonably meeting the standards of the System for the design year of 1975 and was determined to be structurally inadequate for the design year of 1983, an additional stage of construction or reconstruction was eligible for Federal Aid Interstate fund participation if undertaken during the life of the Interstate Program.

"The design traffic analysis period for the ultimate structural design (might) be twenty years from the date of authorization of the additional pavement construction. However, for Federal Aid Interstate participation the traffic analysis period (was) to be 1983 regardless of whether the additional stage construction was authorized in 1964 or (was) authorized in 1972."<sup>32</sup>

If the State desired to construct an additional stage of pavement for more than the design of 1983, Federal Aid Interstate funds would participate only in the increments of pavement for 1983 traffic; however, Federal Aid Primary or Urban funds could be used for the increment of additional stage construction beyond 1983.



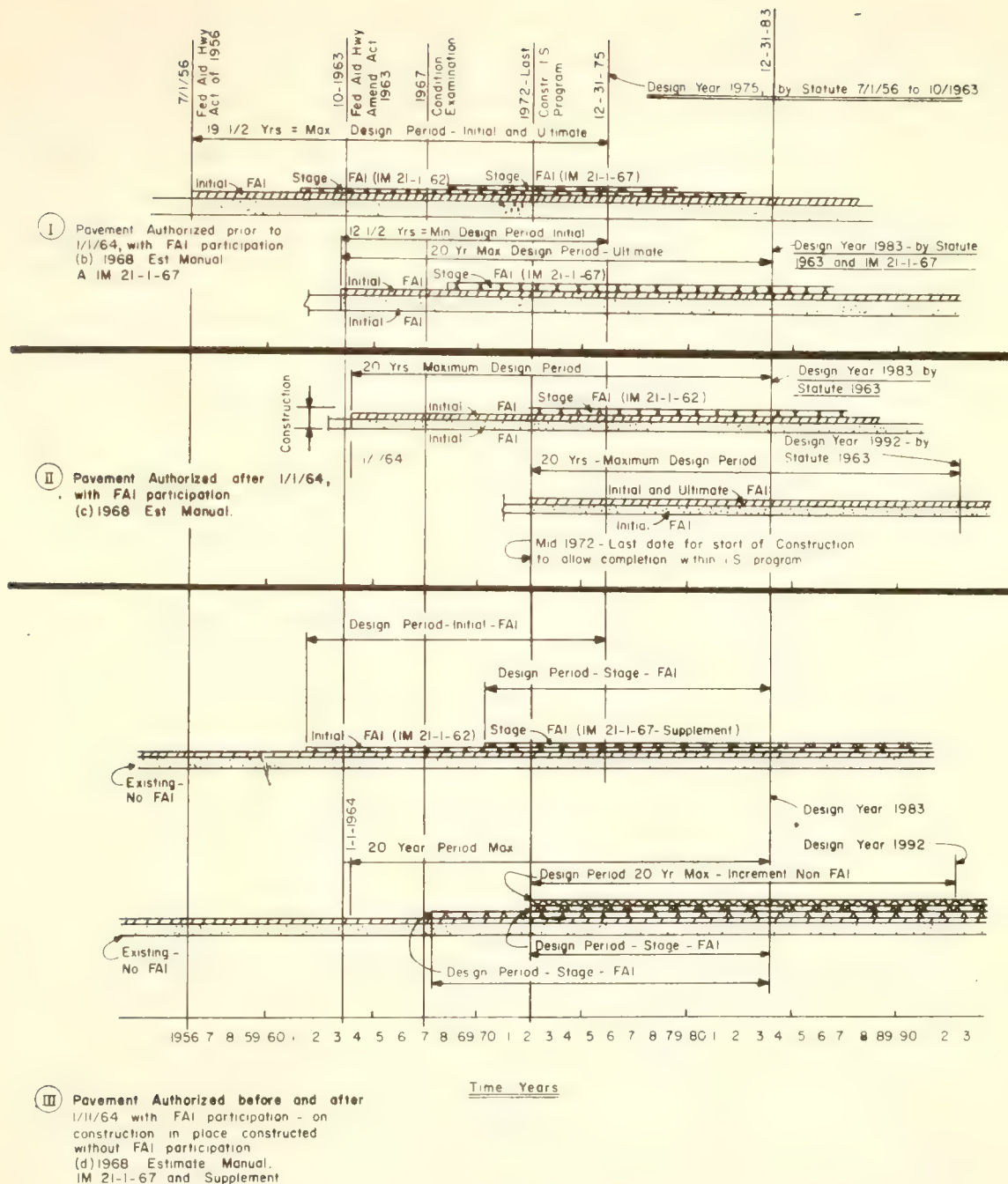


FIGURE 15. FEDERAL PARTICIPATION IN COST OF ELIMINATING PAVEMENT DEFICIENCIES<sup>33</sup>





The Indiana State Highway Commission closely followed the AASHO method to select the most economical pavements. Based on traffic assignments and known loadings, the designer determined the pavement type alternatives which have equal load carrying capacities. Based on road life studies, the alternatives were compared on the basis of net present cost or annual cost. The cost of resurfacing was considered in pavement selection; however, the annual maintenance cost was not considered because the operating maintenance cost was not well defined for specific pavement types.

From the economic analyses and design concepts of the time, reinforced concrete (rigid pavement) was found superior to flexible pavement for many years and was used on a majority of the Indiana Interstate mileage. Indiana considered flexible pavement on all sections of the Interstate as the Program progressed; but it was found that flexible pavement required a granular section which was 25" to 26" in depth with 6" of stabilized material. On this basis, the rigid pavement was always a more economical section.

With the concept of deep strength flexible pavement, design analysis resulted in flexible and rigid pavements becoming more competitive. Flexible pavement is being used on portions of Interstate 64 in the latter part of the Interstate Program.

Safety in Design. The Interstate System was conceived with highway safety as one of the major objectives. Safety was incorporated into the design features of the Interstate System by including such criteria as complete grade separation, fully controlled access, dual-lane highways with wide medians and paved shoulders, and long sight distances in the Interstate design standards. When the Interstate Program was approved in 1956, highway user safety had become a more important factor in highway design.



### Safety Provisions for Roadside Features and Appurtenances.

As the Interstate Program progressed, design standards were modified to make the Interstate System even safer for travel. A major Bureau of Public Roads memorandum on safety was distributed on November 29, 1963. On January 22, 1964 and June 22, 1964, the Bureau of Public Roads issued circular memoranda on safety demonstration projects to develop suggestions to minimize the number and effect of collisions with sign and lighting supports, guardrails, and other roadside features. Subsequently, the suggestions were published on December 22, 1965.

With the President's Message of March 2, 1966 which urged all Federal agencies to improve highway safety, the Bureau of Public Roads made a thorough review of the design features of all Federal aid programs. As a result of the review, the Bureau of Public Roads made it general policy that all aspects of location, design, traffic control, drainage features and roadside appurtenances were to be examined during all phases of design, construction and post construction to insure that vehicle hazards received primary consideration.

The Instructional Memorandum 21-6-66 of August, 1966, (Subject: Safety Provisions for Roadside Features and Appurtenances) set forth four major objectives in designing for safety.<sup>34</sup> The first objective called for clear roadside cross sections and the elimination of nonessential supports and appurtenances. A desirable roadside was one that was clear of all nonessential obstacles for at least twenty feet and preferably more beyond the shoulder and had full-rounded ditch sections and six to one or flatter side slopes. The second objective called for the placement of necessary supports and appurtenances laterally or longitudinally to minimize the hazard of collision. The third objective recommended the use of breakaway or yielding supports for lighting standards or sign supports that were located adjacent to the shoulder





for reasons of necessity. The last objective provided for the use of a guardrail when it was not possible to eliminate a support, light standard or other possible roadside hazard; to use a breakaway or energy-absorbing design; or to locate the sign or luminaire on a highway overcrossing structure, away from the shoulder or behind other essential guardrail. This provision called for a seventy-five foot guardrail segment in advance of the obstacle, a twenty-five foot segment beyond the obstacle if the trailing end of the guardrail was not anchored, and the leading end of the guardrail to be flared and anchored or an equivalent design to lessen the hazard created by the guardrail end itself.

With rising public expectation in regard to highway safety the Federal government became more involved in highway safety with the passage of the Highway Safety Act of 1966. The National Highway Safety Advisory Committee, established by this act, developed Highway Safety Program Standards to which the States must adhere. One of the standards emphasized the importance of safety in the design, construction and maintenance of highways and required the States to use the AASHO safety design standards. The Report on the Highway Safety Program Standards of July of 1967 called for the utilization of "design standards relating to safety features such as sight distance, horizontal and vertical curvature, spacing of decision points, width of lanes, etc., for all new construction and reconstruction at least on expressways, major streets and highways, and through streets and highways".<sup>35</sup> It also called for standards to provide a safe traffic environment for pedestrians; roadside lighting; the design and construction of pavement with high skid resistant qualities; the guidance, warning and regulation of traffic approaching construction sites; the elimination of hazards at dangerous railroad crossings; maintenance of the roadway and roadside consistent with design standards; the identification and correction of hazards within





the highway right-of-way; highway design and construction features to prevent accidents and reduce their severity; and the development of a post-crash program which included signs at interchanges informing motorists of hospital locations, special egress and access features for emergency vehicles and training highway maintenance personnel for emergencies. Under the provision for safety features in design and construction, the report stated the following:

"There are highway design and construction features wherever possible for accident prevention and survivability including at least the following:

1. Roadsides clear of obstacles, with clear distance determined on the basis of traffic volumes, prevailing speeds, and the nature of development along the street or highway.
2. Supports for traffic control devices and lighting that are designed to yield or break away under impact wherever appropriate.
3. Protection devices that afford maximum protection to the occupants of vehicles wherever fixed objects cannot reasonably be removed or designed to yield.
4. Bridge railings and parapets which are designed to minimize severity of impact, to retain the vehicle, to redirect the vehicle so that it will move parallel to the roadway, and to minimize danger to traffic below.
5. Guardrails and other design features which protect people from out-of-control vehicles at locations of special hazards such as playgrounds, schoolyards and commercial areas."<sup>36</sup>

The monumental step to place the objective of safe design into practice came in February of 1967. The publication of the February 1967 Report of the Special AASHO Traffic Safety Committee - Highway Design and Operational Practices Related to Highway Safety - started a revolution in highway design for safety. The provisions of this report have become an integral part of the design process



and have confirmed the provisions and objectives of Instructional Memorandum 21-6-66 of August 1, 1966 (Subject: Safety Provisions for Roadside Features and Appurtances). In accordance with the general policy established on August 1, 1966, the Bureau of Public Roads required the State highway departments to incorporate the additional safety features of the February 1967 Report in the design plans of all new projects as a necessary condition for the approval of final plans, specifications and estimates by the Bureau of Public Roads and in change of work orders for projects under construction. On the completed sections of all Federal aid highways, the State highway departments were asked to establish a corrective program to apply the findings of the February 1967 Report, known as the Yellow Book.

The February 1967 Report covered the broad scope of highway safety in design, construction and maintenance with recommendations on interchange design, roadside design, traffic operations, motorist services, minor physical improvements, and protection for motorists during construction and maintenance operations. The general recommendations to improve highway safety in roadside design and appurtenances included the following: embankments and slopes of six to one or flatter; shoulder width structures; a thirty-foot recovery area free of physical obstructions; the removal of structures and unyielding signs from the gore area at the divergence of two roadways and interchange exits; the removal of nonessential signs; the placement of signs thirty feet from the pavement; an increased use of overhead signs for multilane facilities; the utilization of breakaway and yielding sign supports and light standards with concrete bases flush with the ground; a consistent nationwide policy for the application of guardrails - guardrails tied to structures, approach ends of guardrails





flared away from the road or buried, curbs prohibited in front of guardrail, and a maximum spacing of 6'3" for guardrail posts in median or marginal barrier at high exposure locations; a desirable median width of sixty to eighty feet, the utilization of median barriers for median widths of thirty feet or less, the strict control of median cross-overs and the paving of narrow medians to eliminate maintenance; the utilization of two-span bridges for overpasses crossing divided highways to eliminate bridge piers adjacent to the outside shoulders; adequate median barrier protection for motorists when twin bridges are used on divided highways and the provision for a continuous bridging of the undercrossing when the separation is only twenty to thirty feet; use of separate truck-climbing lanes and escape areas where appropriate; and the use of lighting at critical locations such as weaving areas, exit and entrance ramps and junctions.<sup>37</sup> The recommendations of the report on traffic operations will be discussed in a later subsection on traffic control devices.

There have been only a few minor changes in design for safety since the publication of the Yellow Book in 1967. These safety design standards had a major impact on the design of all highway facilities and particularly the Interstate System since it was the most active program and most heavily traveled system. The impact was also significant in that the safety design standards were retroactive, and the State highway departments including Indiana have established programs for correcting deficiencies in safety features for all highways and particularly the Interstate System.

Evolution of the Interstate System Cross Section. The twelve-foot travel lane, the eleven-foot stabilized shoulder on the right with ten feet paved and the four-foot stabilized and paved shoulder on the left have been design



standards throughout the Interstate Program for most of the Nation and the State of Indiana. For divided highways having six or more lanes, a full width shoulder on the left may be used because the driver in distress in the lane nearest the median may be unable to maneuver to the right shoulder. [Refer to Figure 16 (p. 190) for typical cross sections in Indiana].

The initial minimum right-of-way width for the Indiana Interstate System was 200 feet without frontage roads, 250 feet with a frontage road on one side and 300 feet with a frontage road on both sides for four-lane divided highways in rural and urban areas. A standard 200 foot right-of-way width was used for those sections of Indiana Interstate route completed in the early stage of the Interstate Program (prior to 1965). For a short period during the middle of the Interstate Program, approximately 1965 to 1968, some sections of the Indiana Interstate System were completed with a standard 230-foot right-of-way width. In the latter part of the Interstate Program (since 1968), sections of the Interstate System have been completed with a standard 260-foot right-of-way width. [Refer to Table 9, p. 191].

Early in the Interstate Program, Indiana built some four-lane segments of the rural Interstate System with standard fifty-foot medians. However, a majority of the four-lane rural Interstate System in Indiana was built with a standard sixty-foot median in accordance with the recommendations of the Yellow Book of 1967. The six-lane segments of the Interstate System in rural and suburban areas utilized a standard thirty-six foot median with the exception of some standard forty-foot medians.

In the urbanized areas, the median on the Indiana Interstate System varied from fourteen to twenty-six feet, was paved, and contained a median barrier. In the























Indianapolis Area, a sixteen-foot paved median with barrier was utilized on six-lane Interstate 65 from the southeast system interchange of the Inner Belt to West 38th Street and six-lane Interstate 70 from Holt Road to the northeast system interchange of the Inner Belt. On the early segments of urban Interstate in the Louisville Metropolitan Area, a fourteen-foot paved median with barrier was used on Interstate 64 from the Ohio River to north of Cherry Street in New Albany, and a fifteen-foot paved median with barrier was used on Interstate 65 from the Ohio River to Stansifer Avenue in Jeffersonville. With the addition of a lane for each direction on the inside, the initial rural fifty-foot median was reduced to a twenty-six foot paved median with barrier on the Tri-State Highway from the Illinois State Line to Interstate 65 and on the West Leg of Interstate 465 from US 40 to US 36.

The Indiana East-West Toll Road has a fifty-six-foot median in rural areas and a twenty-foot paved median with eight-foot paved shoulders and four-foot wide curb in the restricted right-of-way sections of urban areas. [Refer to Table 9 , p. 191, for median widths on routes in Indiana].

Median design depends upon two considerations - enough width to prevent a crossover and a head on collision with opposing traffic and enough width to shadow trucks. In the early 1940's, when the first divided highways were built, the design speed was only 50 mph and there were no semi-trailer trucks. Thus, a thirty-foot median width was adequate for a driver to regain control of the vehicle without endangering opposing traffic and for shadowing a truck to prevent protrusion into the through lanes. With the advent of the semi-trailer truck and higher design speeds, the thirty-foot median soon became obsolete. The fifty-foot median of the Tri-State Highway appeared adequate for a 70 mph design speed and was accepted by Indiana for



the Interstate System Program in the early stages. However, additional research and the increasing emphasis on safety made a median width of 60 to 80 feet more desirable. Thus, Indiana used a sixty-foot standard median for all four-lane rural Interstate segments except those built early in the Interstate Program.

In urban areas, higher right-of-way costs led to the use of a narrower median. The six-lane divided, urban freeway with a thirty-six foot median was based on a four-lane divided freeway with a sixty-foot median which had an additional lane each direction on the inside. The six- or more-lane divided freeway with a sixteen-foot median was based on a four-lane divided freeway with a forty-foot median and fifty-mile per hour design which had an additional lane each direction on the inside.

In the early portion of the Interstate Program, there was considerable controversy over the degree of slope in the median. Prior to the Interstate Program, Indiana had followed the general policy of the era by building some of the divided highways with steep median slopes (four to one or steeper) to improve drainage and to prevent cars from crossing the median into the path of oncoming traffic. The four to one slope was also used for the median slope of the Indiana East-West Toll Road. Knowledge from the accident experience of these steep median slopes led the Indiana State Highway Commission to prefer lesser median slopes because a loss of control on the shoulder and tipping over in the median had proved more likely than a collision with oncoming traffic. The Bureau of Public Roads originally refused to allow lesser median slopes and wanted even steeper slopes prior to the Interstate Program; however, the States with the backing of the AASHO persuaded the Bureau of Public Roads to require lesser median slopes.





Indiana's maximum median slope prior to 1967 was predicated on longitudinal drainage of the median. The spacing of inlets controlled the median slopes to a great extent. When flatter slopes were required in 1967, Indiana went from an inlet spacing of 500 feet to an inlet spacing of 200 feet or less to enable a flatter slope between the pavement edge and the flow line of the median ditch. In general, Indiana has always used a twelve to one slope for the first seven feet of the median beyond the four foot left shoulder. Prior to 1967, the Indiana State Highway Commission varied the median slope beyond eleven feet of the pavement edge from an eight to one slope to a three to one slope (which was used on rare occasions) with most median slopes at four to one. When the Yellow Book of 1967 dictated that a six to one slope was the maximum within thirty feet of either side of the pavement, the Indiana State Highway Commission went to a maximum slope of six to one in the median. For Indiana, the six to one requirement brought little change in their median design policy.

In Indiana, the slopes beyond the right shoulder varied from four to one to two to one, depending on the amount of fill, with most at four to one. Since 1967, the Indiana State Highway Commission has used a maximum slope of six to one for thirty feet beyond the right pavement edge.

Evolution of Bridge Design. The greater emphasis on safety and the deemphasis of highway cost has resulted in an evolution of bridge design. During the Interstate Program, there was a general evolution in design, materials, geometrics, and knowledge about the frequency of loading and fatigue of bridges.

The AASHO loading of H20-S16, a thirty-six ton semi-trailer truck, has been used throughout the Interstate Program to design bridge structures. However, a military loading was superimposed over the standard loading for those Interstate routes in the Strategic Highway Network.



When the Geometric Designs Standards for the National System of Interstate and Defense Highways was adopted on July 17, 1956, a minimum vertical clearance of fourteen feet was specified. To maintain this standard throughout the life of the project, a 14'6" vertical clearance was constructed to allow for resurfacing. In a couple of years, the minimum vertical clearance was revised to fifteen feet and a 15'6" vertical clearance was used for initial construction. Finally, in January of 1960, the minimum vertical clearance was revised to sixteen feet to accommodate military vehicles on all routes. Prior to 1960, only Interstate Routes in the Strategic Highway Network were required to have sixteen-foot clearances. Since this revision came early in the Indiana Interstate program, most structures were modified during construction either by a change in construction plans or by jacking up the bridge deck, modifying the substructure and lowering the bridge deck back in place. Only Interstate 65 from Jeffersonville to Taylorsville and Interstate 74 at Pleasant View were affected because the other Interstate routes were only in the design phase at the time of revision. Since 1960, Indiana has used a 16'3" vertical clearance to accommodate resurfacing.

When the Interstate Program began, only individual span structures less than 150 feet in length could be built to shoulder width with Federal Aid Interstate funds. For bridges less than 150 feet long, the maximum clearance eligible for Federal Aid Interstate fund participation was ten feet on the right from the pavement to the parapet or bridge rail, and six feet for four- and six-lane divided highways or ten feet for eight- or more-lane divided highways on the left from the pavement to the parapet or bridge rail. The minimum clearance requirement for bridges less than 150 feet was six feet on the right and 3'6" on the left from the pavement to the parapet or bridge rail. For bridges



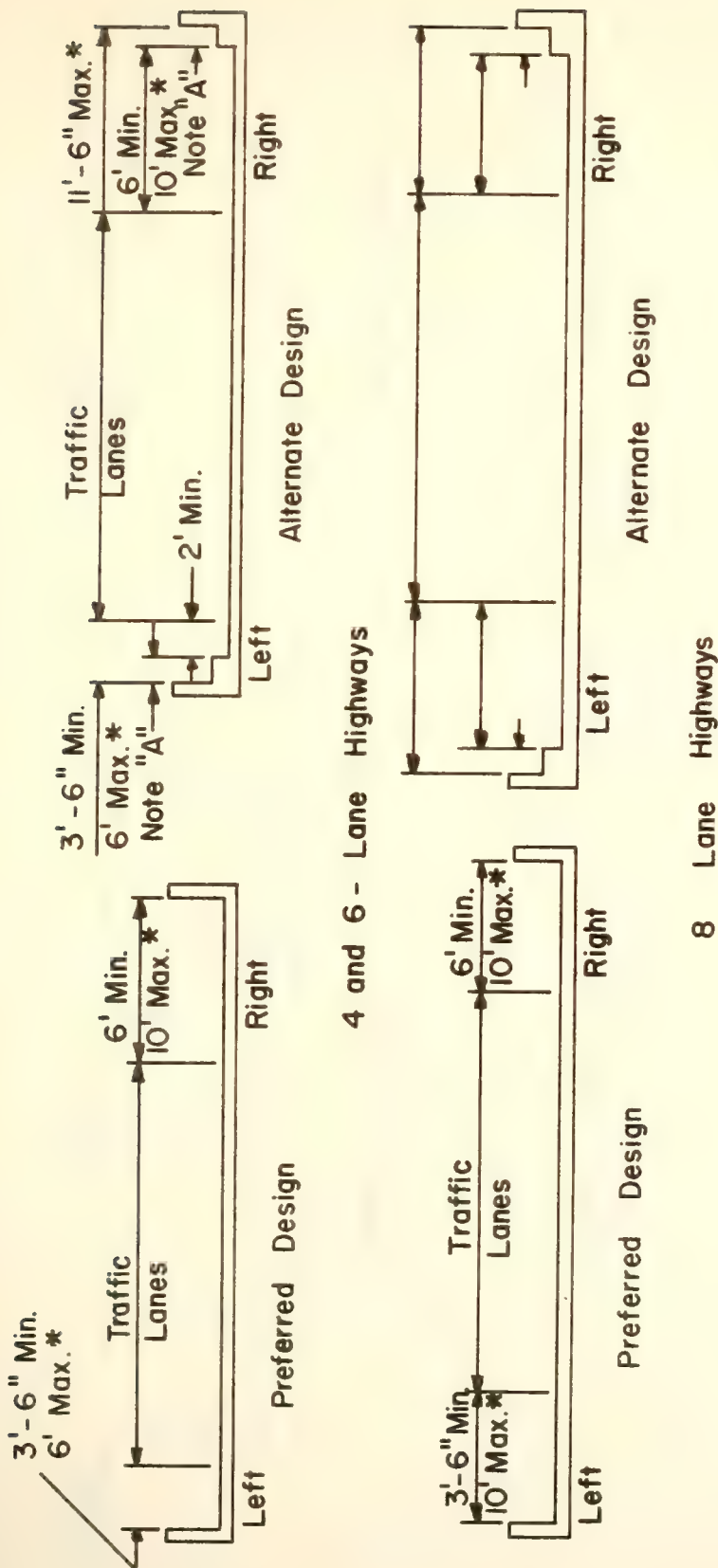


longer than 150 feet in length, the maximum distance eligible for Federal Aid Interstate fund participation was five feet on the right or left from the pavement to the parapet or bridge rail; the minimum distance requirement was 3'6" on both sides.

On April 12, 1963, the AASHO policy on Interstate bridge widths was revised. Shoulder width structures up to 250 feet long in rural areas and up to 200 feet long or with a design hourly volume greater than 1125 vehicles per lane in urban areas were eligible for Federal Aid Interstate fund participation. On October 24, 1963 and May 15, 1965 minor modifications were made in the bridge dimension standards to insure compatibility with revised AASHO geometric design standards.

The AASHO adopted drastic changes in the Geometric Design Standards for the National System of Interstate and Defense Highways in regard to bridge widths on October 15, 1966. The new standards recommended shoulder width structures for all Interstate overcrossing structures in rural and urban areas without length or design hour volume per lane limitations except for major long span bridges. [Refer to Figures 17, 18 and 19, pgs. 199-201]. According to the revised standards, the maximum distance from the right edge of the pavement to the face of a parapet or rail eligible for Federal Aid Interstate fund participation was ten feet without curbs, 11'6" with a safety barrier curb of a maximum width of 1'6", or 10'9" with a brush curb of a maximum of 9". The minimum distance from the right edge of the pavement to the curb or parapet, if no curb exists, was six feet. The maximum distance from the left edge of the pavement to the face of the parapet or rail eligible for Federal Aid Interstate fund participation was six feet including the curb (if provided) for two- or three-lane directional separate bridges and ten feet without curb





\* Maximum distance for determination of FAI participation

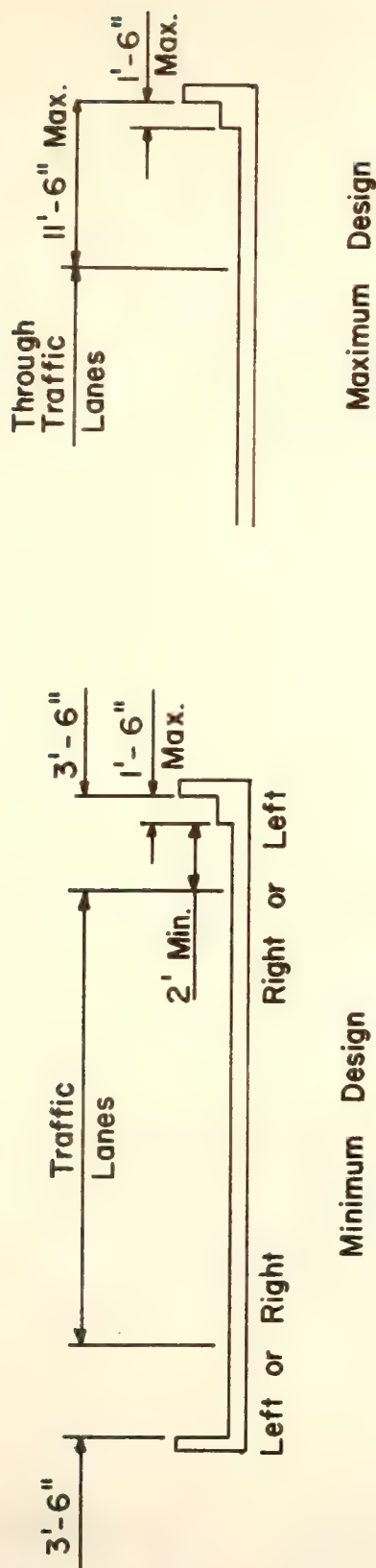
Note "A"

1' - 6" Maximum Safety Barrier Curb  
9" Maximum Brush Curb

Number of Lanes -- 4, 6, 8 or More

FIGURE 17. HORIZONTAL CLEARANCES - ALL INTERSTATE OVERCROSSING STRUCTURES EXCEPT MAJOR LONG SPAN STRUCTURES<sup>40</sup>





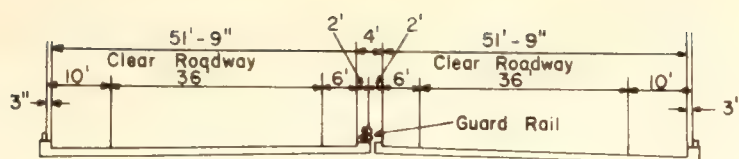
Design Widths Between 3'-6" Minimum and 11'-6" Maximum  
Determined by Individual Case Analysis, Both Right and Left

Number of Lanes -- 4, 6, 8, or More

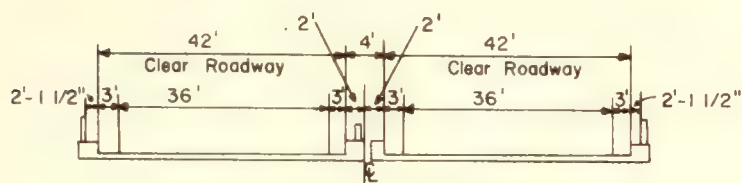
FIGURE 18. HORIZONTAL CLEARANCES - MAJOR LONG SPAN STRUCTURES  
INTERSTATE SYSTEM OVERCROSSINGS <sup>41</sup>



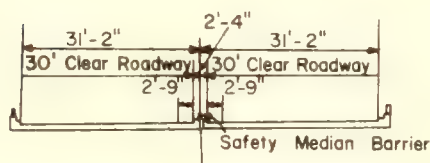




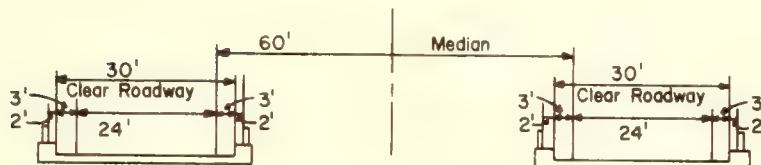
North Leg of Indianapolis Inner Belt (Interstate 65)  
 Bridge over White River on Interstate 65  
 Bridge over White River on Interstate 70



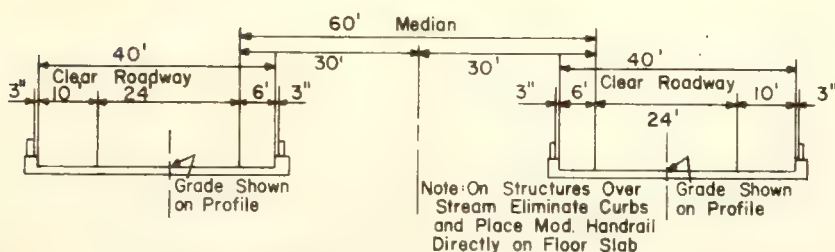
Sherman Minton Bridge over Ohio River on Interstate 64  
 Kennedy Bridge over Ohio River on Interstate 65



Bridge over Ohio River on Interstate 275



Bridge over Wabash River on Interstate 64,  
 on Interstate 70 and on Interstate 74



Bridge over Wabash River on Interstate 65

Scale: 1/20" = 1'

FIGURE 19.

HORIZONTAL CLEARANCES MAJOR SPAN  
 STRUCTURES IN INDIANA<sup>42</sup>



(10'9" with brushed curb or 11'6" with safety barrier curb) for four- or more-lane directional separate bridges. The minimum distance requirement of 3'6" (including the curb) from the left edge of the pavement to the parapet remained the same.

For major long span structures, the design dimensions were a minimum of 3'6" (including curb) from the right or left edge of the pavement to the parapet and a maximum the same as the other bridges for Federal Aid Interstate fund participation, provided the added cost of shoulder width dimensions for major long span structures was justified by tangible benefits to the users and operations on the structure.

Referring to Figure 20 (p. 203), the bridge clearances for auxiliary lanes varied from a minimum of two feet both right and left from the edge of pavement to the parapet to a maximum of six feet (including curb) on the right and three feet on the left without curb or 4'6" on the left with a safety barrier curb.

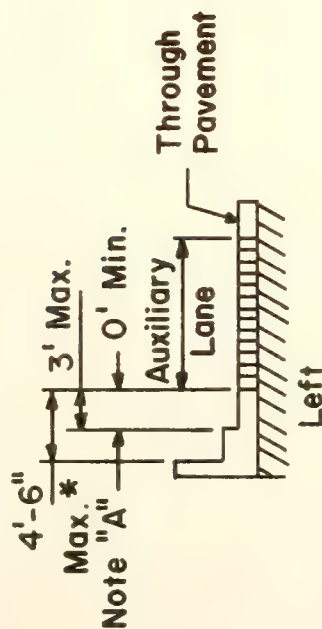
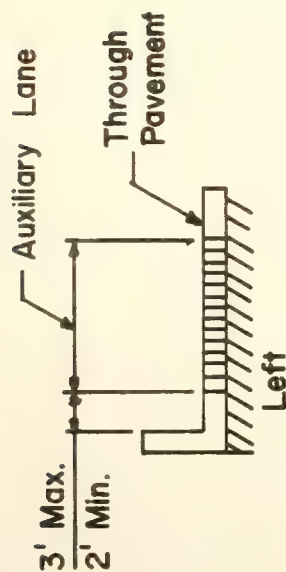
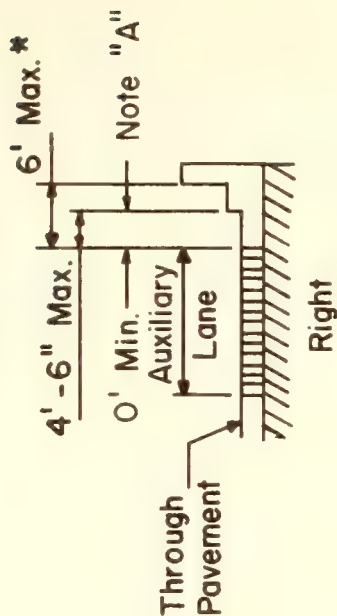
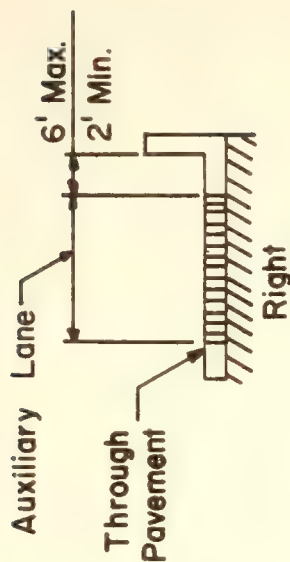
This new policy was not intended to be retroactive; however, the Bureau of Public Roads did not object to the modification of the designs of bridges not yet constructed.

The maximum dimensions eligible for Federal participation have been the preferred dimensions for Interstate structures for reasons of safety, and the maximum dimensions were expanded when the greater widths could be justified from the standpoint of user benefits. The Indiana State Highway Commission has always designed Interstate structures with the maximum dimensions eligible for Federal participation and has always pushed for shoulder width structures without length, type of area, or volume limitations.

With the publication of the Yellow Book in February of 1967, the Federal Highway Administration set forth on







## Preferred Design

## Alternate Design

**\*\* Maximum distance for determination of FAI participation**

Note "A"

**1'-6" Maximum Safety Barrier Curb**  
**9" Maximum Brush Curb**

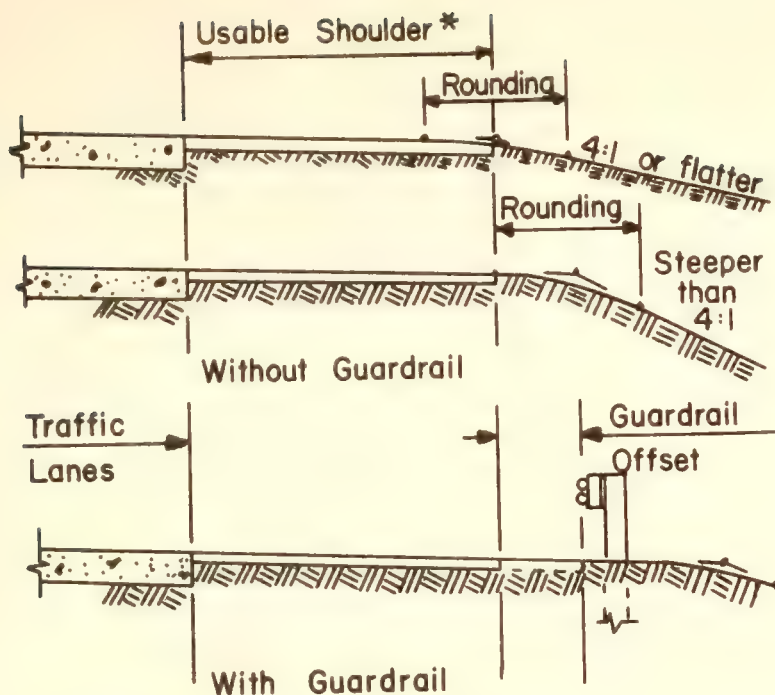
FIGURE 20. HORIZONTAL CLEARANCES - AUXILIARY LANES INTERSTATE SYSTEM OVERCROSSINGS<sup>43</sup>



October 3, 1967 the policy that "the usable width of shoulders designed for Interstate highway roadways between bridges, and the usable widths of shoulders designed for bridges and other structures that carry Interstate highway traffic (through lanes, auxiliary and speed change lanes, turning roadways, ramps, loops, and direct connections) are to be the same to the maximum extent practicable and feasible.<sup>44</sup> The AASHO safety report recommended that guardrails be installed with the face of the rail a minimum of two to three feet from the edge of the shoulder and at least twelve to thirteen feet from the edge of the pavement and that guardrails on the approaches to structures be tied to the structure. [Refer to Figures 21 & 22, pgs. 205-206].

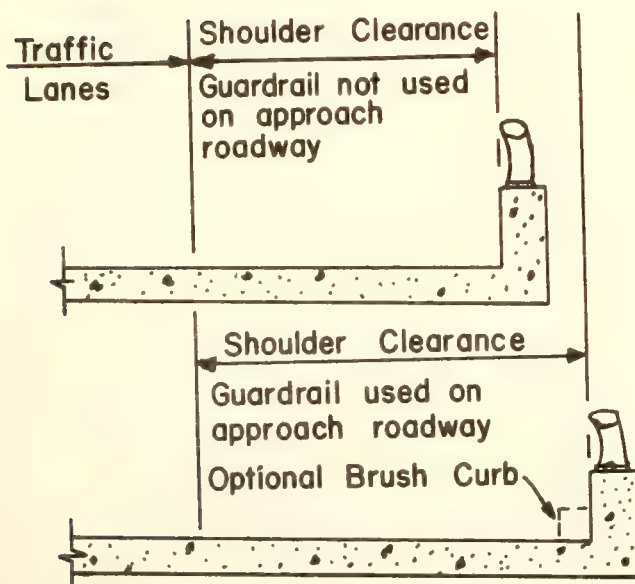
To implement the AASHO recommendation on guardrail placement and to permit the bridge railing to line up with the approach guardrail, the dimension eligible for Federal Aid Interstate fund participation from the right edge of the pavement to the face of the guardrail and bridgerail may be up to twelve feet for usual design conditions and up to fourteen feet if the design hourly volume for trucks equals or exceeds 250 trucks per hour. The standard left clearance is six feet for four- and six-lane freeways and may be up to twelve for eight- or more-lane freeways. A maximum 9" brush curb may encroach on the standard clearance provided suitable transitions are provided at the bridge ends or the brush curb is an extension of a dike or curb on the highway approaches. However, the Yellow Book strongly recommended that dike or curb not be used in front of a guardrail because they cause a dynamic jump of the vehicle before it strikes the barrier. The AASHO safety report found that safety walks on bridges caused the vehicle to catapult over the parapet. Thus, AASHO recommended and the Federal Highway Administration required that safety





\* Shoulder usable by all classes of vehicles in all weather. Minimum usable shoulder width is 10 feet on the right except in mountainous terrain involving high cost for additional width in which case the usable width may be less than 10 feet but not less than 6 feet.

#### APPROACH ROADWAY



#### BRIDGE ROADWAY

Maximum width bridge shoulder clearance on the right for FAI fund participation is 12 feet except it may be approved for 14 feet when the DHV includes 250 or more trucks per hr.

Maximum width bridge shoulder clearance on the left for FAI fund participation is 6 feet for 2-lane and most 3-lane one directional flow bridges and up to 12 feet for 4-lane one directional flow bridges.

FIGURE 21. GUARDRAIL PLACEMENT<sup>45</sup>





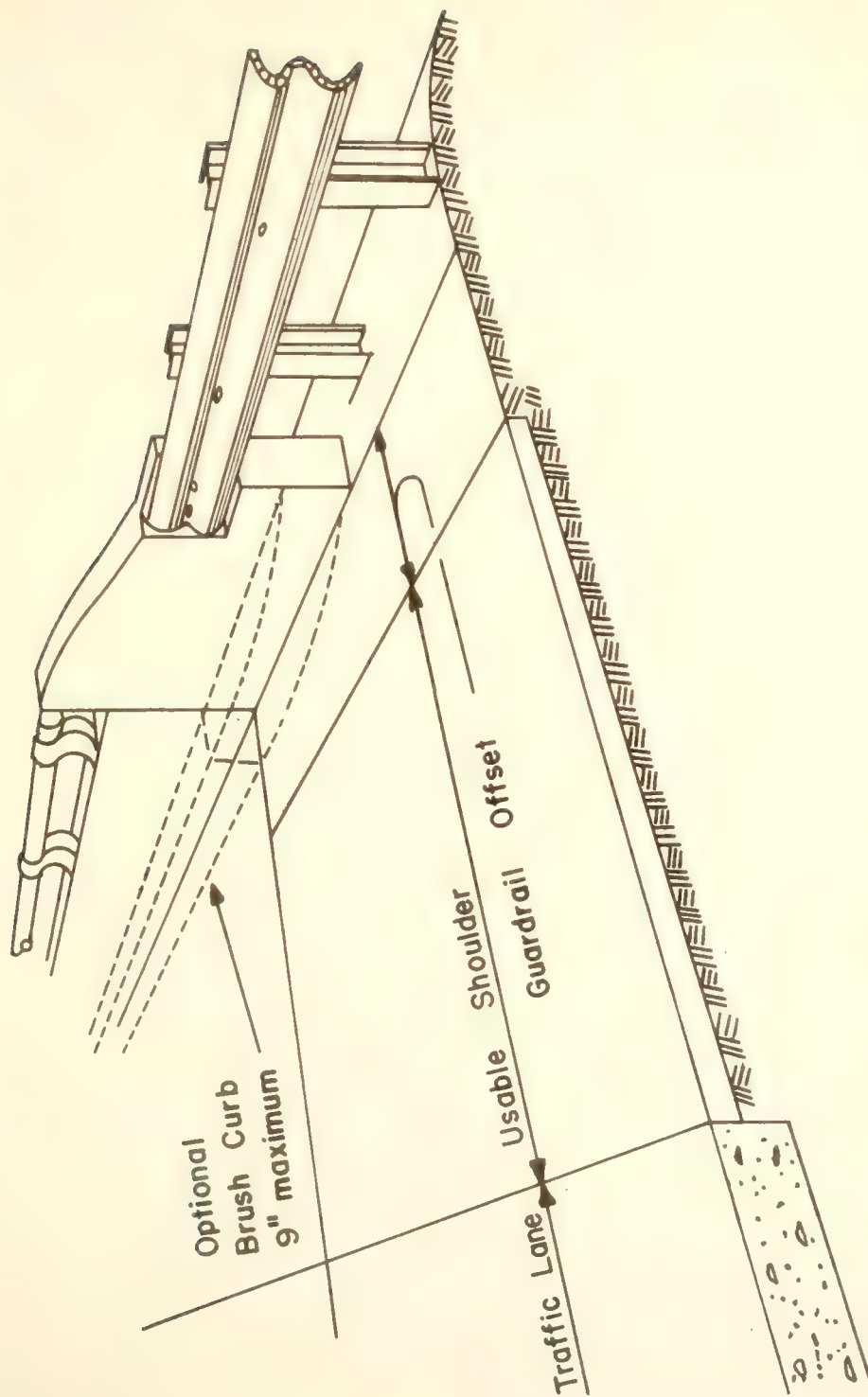


FIGURE 22. GUARDRAIL - BRIDGERAIL TRANSITION<sup>46</sup>



walks be eliminated from all future designs and from existing bridges to the extent feasible. Safety curbs have been excluded from all Federal Aid fund participation.

In the desire to implement the AASHO policy on the continuity of guardrail and bridge rail, Indiana has gone to a continuous guardrail - bridge rail design without concrete parapet or curbs. In urban areas where a curb is needed for drainage, the bridge rail is placed on top of a low curb.

When the Interstate Program began, maximum lateral clearance from the edge of pavement of an Interstate underpass to a bridge pier was generally the shoulder width both left and right. Indiana used a lateral clearance of ten feet from the right edge of the pavement to the face of the pier and thirty feet from the left edge of the pavement to the center of the pier when it was feasible to put a single pier in the middle of the median. When a twelve foot weaving lane was used in a cloverleaf interchange, the right lateral clearance was reduced to six feet.

In 1965, the Bureau of Public Roads encouraged a cost comparison of two-span versus four-span structures to eliminate piers adjacent to the roadway. In accordance with the policy that requires the installation of protective guardrail where hazards next to the shoulder cannot be eliminated or relocated (as set forth by Instructional Memorandum 21-6-66 of August 1, 1966), bridge piers adjacent to the shoulder also require protective guardrail.

With the AASHO recommendation for a thirty-foot recovery area free from hazards on both sides of the pavement in 1967, the bridge piers had to be placed thirty feet from the edge of the pavement. Indiana has always placed the bridge piers in the middle of the median and has since 1967 placed the bridge piers thirty feet from the right edge of the pavement when feasible. However, it was





not always economically feasible to make the thirty-foot offset for piers because of the type of structure, span arrangement, skew or terrain. When hazards were inside the thirty-foot recovery area, Indiana followed the AASHO recommendation of the placing the guardrail two to three feet beyond the shoulder or at least twelve to thirteen feet from the edge of the pavement and attaching the guardrail to the bridge pier if the guardrail was not carried in front of pier. As Indiana used the standard sixty-foot median, a protective guardrail was necessary for the bridge piers in the middle of the median. [Refer to Figure 23, p. 209].

Development of the design for two-span continuous beam structures with spill-through type end bents was primarily due to the necessity to provide shoulder width or greater clearances from the pavement edge. This type of structure was not used on other highways prior to the Interstate Program and would not have been used on the Interstate System if safety was still secondary to economics. The use of continuous beam structures on the Interstate System has also been translated to four-lane divided highways on the Federal Aid Primary System throughout Indiana.

The use of prestressed concrete beams on the Interstate and other systems began in the late 1950's. Because prestressed concrete beam structures were very economical for short spans, their use has steadily increased on all systems in Indiana. Prestressed concrete beam construction was more economical than conventional bridge construction because the spans were fabricated away from the site and falsework was not needed to support the pouring of the bridge deck since the forms could be placed directly on the prestressed beams.

In Indiana, the type of material used in the bridge structure was based on a thorough economic analysis. Although the first or initial cost for each material was the primary consideration, a concrete structure was usually selected if

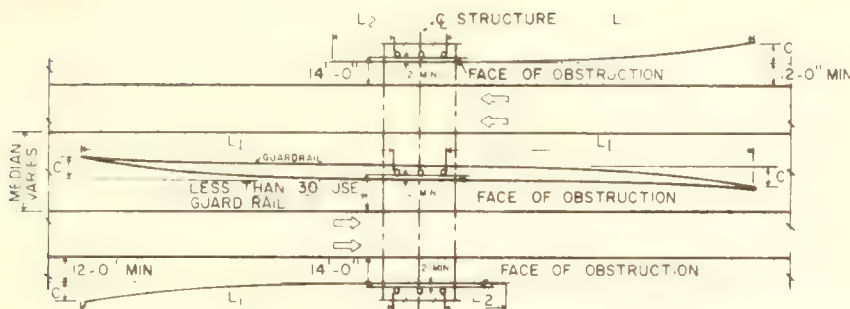


## GENERAL NOTES

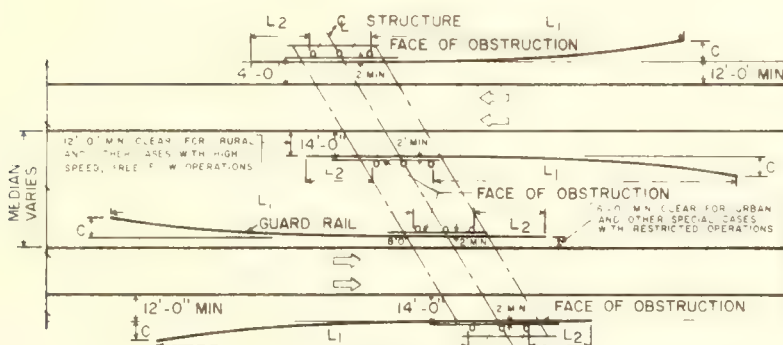
End Treatment Ends of guard rail should be flared and anchored to afford maximum safety for oncoming traffic.

GUARD RAIL LAYOUT DIMENSIONS		
Dimension	Desirable	Minimum
C	8'-10'	4'
L <sub>1</sub>	*125' or 150'	*75' or 100'
L <sub>2</sub>	75'	*50'

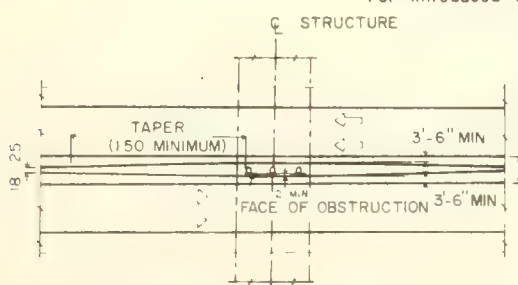
\* 25' IF END ANCHORAGE IS USED  
 \*\* USE LARGER VALUE



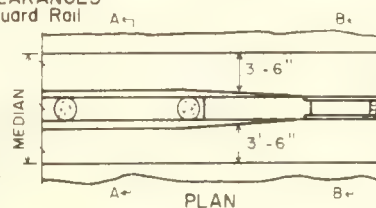
TYPICAL INSTALLATIONS  
 For Introduced Guard Rail



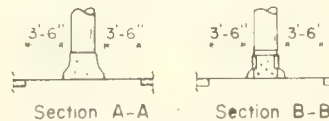
MINIMUM CLEARANCES  
 For Introduced Guard Rail



GUARD RAIL TREATMENT



ALTERNATE TREATMENT



CONSTRUCTIONS IN NARROW MEDIANS

FIGURE 23. ROADSIDE CLEARANCE TO BRIDGE SUPPORTS<sup>47</sup>  
 FOUR-LANE DIVIDED HIGHWAY — RECOMMENDED GUARD RAIL  
 INSTALLATIONS



the first cost for a concrete or steel structure was equal, on the basis of the cost of painting the steel structure. Weathering steel if exposed to water or salt was not considered superior to regular steel by the Indiana State Highway Commission. However, the development of concrete deterioration of bridge decks has generally offset the cost of painting steel bridges.

**Traffic Control and Protection Devices.** At the beginning of the Interstate Program, guardrails were installed without flared and buried approach ends and were not used to protect vehicles from bridge parapets or piers. The unburied guardrail end was as hazardous to vehicles as any other object. A guardrail was soon added to the approach to the bridge parapet or pier; however, because the guardrail was not attached, it sometimes directed the vehicle into the parapet or pier. By 1966, the guardrail was tied to the bridge parapet or pier to insure continuity of alignment and was installed with the approach ends flared and buried.

With the publication of the AASHO safety policies in 1967, curbs and safety walks were eliminated from the front of guardrails and bridge rails. Guardrails were required if the median width was less than thirty feet or if the bridge pier was less than thirty feet from the pavement edge. Both ends of the median guardrail were buried as both ends were approach ends. Guardrails were also required where there was an opening in the median between twin bridge structures to redirect the vehicle from the opening; prior to 1967, concrete walls perpendicular to the median were sometimes used to close off the opening. Beginning in 1967 and more extensively in the latter part of the Interstate Program, the bridge parapets were eliminated from the design of new structures and replaced by a continuous guardrail - bridge rail with buried approach ends; when the structure crossed other than a stream, the continuous guardrail was placed on a low curb. Most recently, impact absorbing devices have





been used on an experimental basis to protect vehicles from hazards in the gore area of the divergence of two roadways.

Although the use of breakaway sign supports and light standards preceded 1967, extensive use of the devices did not occur until 1967. Through research it had been discovered that wind loading requirements resulted in more massive supports than were desirable and that the consequences of a vehicle hitting the supports were far more serious and frequent than having the sign blown over by high winds.<sup>48</sup> The new safety policy recommended the removal of auxiliary signs, the greater utilization of bridge structure for signs, the placement of signs beyond the thirty-foot recovery area when possible, the use of guardrail protection for signs that could not be relocated from the thirty-foot recovery area, and the use of sign and light foundations flush with the ground.

In the area of traffic operations, the Yellow Book recommended that larger traffic signs be used at maintenance and construction sites; that greater consideration be given to transition between facilities of different design; that "One Way", "Do Not Enter" and "Wrong Way" signs be used at all ramps and crossroads when needed to prevent or redirect wrong-way traffic; that care should be used in determining longitudinal joint locations so that the driver was not guided into a hazardous situation; that edgemarkings be used along the Interstate; that mileposts be installed on the Interstate; that lane drops be avoided or the driver given sufficient warning; and that trucks and buses be prohibited from the left lane of a multi-lane facility.

Considerations in Grade Treatment. The decision to design an elevated, depressed or at-grade facility involves a number of considerations.

The depressed facility is aesthetically pleasing since it does not disrupt the existing view or present a visual



barrier. The grades of the facilities overcrossing the Interstate remain unchanged and the depressed Interstate does not prohibit the addition of more overcrossings. The depressed facility contains vehicle noise and air pollution; however, poor air circulation in the trench may cause vehicle pollution to stand in the facility. The depressed facility necessitates the relocation of underground utilities at high cost. The depressed facility may also require an extensive storm water drainage system. The ground water table may cause problems in depressing a facility, and snow removal from a depressed facility is a definite problem. In constructing a depressed facility, all commercial facilities along the route are closed off and all cross traffic is halted.

Because an at-grade facility is not hidden from view, it is not as aesthetically pleasing as a depressed facility. However, an at-grade facility does not disrupt the skyline and can only be recognized when the viewer is in close proximity. The grades of all intersecting facilities must be raised to clear the at-grade facility making the use of an at-grade facility unfeasible in a dense urban area. The at-grade facility is a barrier to additional crossings as built up grades and bridges are both required. This type of facility does not contain vehicle noise and air pollution as well as a depressed facility. However, screening can be used to hide the at-grade facility and to reduce vehicle noise. The at-grade facility does not require the extensive relocation of utilities nor the extensive storm water drainage system that the depressed facility requires. During the construction of at-grade facilities, the disruption to commerce and local circulation is not as great as that of depressed facilities.

The elevated facility on structure or fill disrupts the skyline unless the structure is designed with clean lines and few piers to give the illusion of floating on the skyline. The grades of facilities undercrossing the Interstate remain





unchanged, and the undercrossings need not be altered. Additional facilities are easily constructed if the Interstate is on structure, but are difficult to construct if the Interstate is on embankment. The elevated facility disperses vehicle noise and air pollution to a greater extent than the other grade alternatives. Vehicle noise is greater for elevated structures than pavement on embankment because the embankment absorbs noise and can be screened. Screening the noise on a structure involves the construction of expensive concrete walls paralleling the shoulders that are not very effective and are not very aesthetically appealing. The freeway on embankment requires extensive relocation of utilities although not to the extent required by a depressed facility. The freeway on structure requires less utility relocation than the freeway on embankment. An extensive storm water drainage system is not needed for an elevated freeway. The elevated facility is least disruptive to local commerce and traffic circulation. The space below an elevated freeway on structure can be utilized for other purposes, but the cost of the structure is far more expensive than fill.

Evaluation of Design Alternatives. Economic analysis was used extensively in bridge, pavement and geometric design to compare alternatives. In bridge design, structure alternatives (the number of spans or the location of piers) and material alternatives were the major features compared. In pavement design, material alternatives and their thicknesses were compared. In geometric design, the location and justification of interchanges, separation, access roads, auxiliary lanes, collector-distributor systems, grade alternatives and many more features required economic analysis.

Many design decisions involved more than the consideration of highway cost. Highway user benefits (travel service, reduced operating and travel time costs and reduced accidents) and community benefits (economic, social and environmental impacts)



were as important as highway cost in the final decision. With the increasing emphasis on highway safety and community impact, highway cost was often a lesser consideration in the evaluation of design alternatives.

### Evolution of the Interchange

Other than the alignment of the Interstate route, the interchange is the most important element of the freeway system affecting traffic service as it provides access to and from intersecting highways and interconnects the routes of the System. Because the System has fully controlled access, the location and spacing of interchanges determines the utility of the Interstate System to the highway user. The location of interchanges may affect the alignment of the Interstate route or limit the possible corridor alternatives. In rural areas, the location of interchanges has little effect on the general alignment because of the latitude in locating the interchanges. In other words, the interchange can generally be placed wherever the Interstate alignment intersects the crossroad. In urban areas, the latitude in locating the interchanges is restricted by the density of development. In locating the Indianapolis Inner Loop, the location of the interchanges between freeways determined the alignment of the Inner Loop.

The location and spacing of interchanges is determined by the Planning Division of the Indiana State Highway Commission during the route location studies prior to the corridor public hearing. The selection of the interchange type and the geometric design features of the interchange are performed by the Division of Design of the Indiana State Highway Commission after the approval of the route alternative by the FHWA. During the Interstate Program, interchange justification was performed by both the Planning and Design Divisions.





Interchange Location and Spacing. The location and spacing of interchanges on the Interstate System has a profound effect on the transportation network of the State and the urban areas. "The ability of a freeway to carry traffic effectively depends to a great degree on the location and spacing of its interchanges."<sup>49</sup> Widely spaced interchanges provide poor local service in the corridor and may concentrate the collection and distribution traffic at a few points. If heavy interchanging volumes are concentrated at a few points, the freeway may not be able to handle the large volume of interchanging traffic; and the crossroad and local street network may not be able to collect and distribute traffic for the interchange. On the other hand, wide interchange spacing promotes good traffic operations since there are few points on the freeway where merging, diverging and weaving can reduce flow and capacity. More frequent spacing of interchanges provides better local service and distributes interchanging traffic loads over more points reducing the load on the local street network. However, too closely spaced interchanges cause operational difficulties on the freeway because of insufficient room to maneuver between adjacent interchanges and increased friction between through and interchanging traffic. The close spacing of interchanges may also result in the use of the freeway for short trips for which the freeway was not intended.

The final selection of the location and spacing of the interchanges involves a compromise between desirable traffic service and operations on the local street network and desirable operating characteristics on the freeway. The primary determinants in locating and spacing interchanges can be summarized by three major categories: external factors such as the existing street pattern, existing transportation plans, and community objectives on growth and development; internal factors such as geometric features, signing limitations and operational characteristics of the freeway; and





special considerations such as Federal and State policies and regulations.

External Factors. The existing highway system pattern and the character and spacing of crossroads are prime considerations in the location and spacing of interchanges. All major Federal and State highways, major county roads and urban arterials intersecting the Interstate corridor were reviewed to determine the probable volumes of traffic interchanging with the Interstate and the areas served by the Interstate through such interchange locations. The ability of the crossroad and local street system to carry traffic to and from the area served by the interchanges was an important factor in selecting the location for the interchange in the area to be served; this factor was especially important in urban areas where there were several interchange location alternatives. If the crossroad or arterial was the best road to serve the area and was deficient in design and capacity for the traffic of twenty years in the future, the governmental agency having jurisdiction over the crossroad would have to make a commitment to improve the crossroad prior to or concurrently with the construction of the interchange or to improve the crossroad within five years or before the Interstate System is completed, whichever came first. The particular commitment depended on the condition of the crossroad, the funding available for improvement and the possibility of stage construction. The feasibility of improving the crossroad weighed heavily in the decision to locate the interchange.

The future highway system must also be considered in the location of interchanges. Federal law required consideration of the future highway system because the Interstate System was to be designed for the traffic of twenty years hence. If an area had an adopted transportation plan, the Indiana State Highway Commission attempted to coordinate Interstate



improvement with the recommendations of the local transportation plan to insure compatibility with the local plan and to implement the local plan to the extent feasible. Concurrent transportation planning between the State and local agencies has always been desirable. Without local transportation planning, there was no defined future highway system to guide the State highway department in developing the Interstate improvement. Those areas which lacked a continuing urban transportation process and development objectives slighted themselves because the Indiana State Highway Commission had to locate interchanges without local input.

Consideration of the future highway system in locating Interstate interchanges involved more than matching Interstate improvements with the plans of the community. It is an unfortunate fact that the transportation plans developed and officially adopted by one local administration may not be backed nor implemented by subsequent administrations. Another problem is that transportation plans may be wishes rather than plans which can be achieved within the financial capabilities of the community. Moreover, at the present, fiscal responsibility prevents the construction of interchanges and separations to serve would be local highway improvements. Additional interchanges and separations might be necessary to the Interstate System in the future if such local transportation plans are fully implemented. Thus, consideration of the future highway system in Interstate improvement involved such factors as future traffic forecasts, community goals and objectives, the financial capability of the locality to carry out their transportation plans, and a viable commitment of the locality to improve the roads interchanging with the Interstate System.

The cooperative planning process has come into its own on a nationwide basis but after much of the Interstate System had been planned and located. Indiana attempted to locate





interchanges where they would best serve the community as set forth by the recommendations of local transportation plans and not necessarily where a State road converged on the community. When a local government lacked a continuing transportation planning process and failed to make a commitment to improve the desired interchange crossroad, the objective of locating an interchange where it will best serve the community or according to community goals was hampered. Without local plans, objectives and commitments as guidelines, the Indiana State Highway Commission has tended to locate interchanges where they intersected or could be connected with State routes. Where an area had an officially adopted thoroughfare plan, as was true of Marion County and Indianapolis, the interchanges were located on State routes and then supplemented by interchanges on suggested major arterials lacking a State route designation.

The type and density of development traversed by the Interstate System influences the location and spacing of interchanges. Because the density of development increases as the freeway extends from the rural through the suburban to the urban area, there is a corresponding increase in traffic generation and demand for access to the facility. Hence, the spacing between interchanges should decrease as the freeway approaches the center of the urban area. Theoretically large commercial and industrial concentrations require more access points because of the magnitude of traffic generation. In corollary, interchanges are needed at points of high traffic generation such as large industrial plants, airports, stadiums, and convention centers. However, minimum spacing requirements for Interstate interchanges would generally rule out special treatment for major generators in regard to direct access.

In Indiana, there was no special policy for providing access to major traffic generators by the addition of supplemental interchanges after the interchanges for major highways



were located and spaced. There has been pressure for direct ramps to regional shopping centers in the Indianapolis Metropolitan Area, but private developments are forbidden direct access to the Interstate System by Federal regulation. Although special interchange location treatment might be warranted in the case of major generators such as sports arenas and convention centers, these major generators did not exist in Indiana adjacent to the Interstate System during the design of the System. The sports arena and convention centers in Indianapolis came after the Inner Loop was designed and after the Central Business District Circulation System had been determined. Wier Cook Airport received special consideration only as a result of Interstate 465 interchanging with the Airport Expressway, which had been built concurrently with the Interstate.

The density of development in Indiana was not intense enough to create major traffic generators along the Interstate requiring special interchange treatment with the exception of the Central Business District of Indianapolis which warranted a special distribution system. Aside from this exception, the density and type of development adjacent to the Indiana Interstate System was reflected in traffic generation volumes on the highways intersecting the Interstate System which were evaluated for possible interchange locations.

**Internal Factors.** Due to the effect of geometric features on the operating characteristics of freeways, geometric features are the major internal factors influencing the location and spacing of interchanges. The required capacity for a freeway is determined by the amount of through traffic and weaving traffic (traffic merging, diverging and maneuvering on the freeway). The interrelationship between freeway operations and the location and spacing of interchanges can be described as follows:





"The more traffic that is imposed on a facility the more difficult and complex becomes its operation, particularly in conjunction with interchanges. Part of the problem is overcome by expanding the facility laterally, that is, by adding width or lanes. But, much of the problem must be solved by expanding the facility longitudinally, in other words, by increasing lengths of maneuver areas and weaving sections. These play an important role in the spacing of interchanges".<sup>50</sup>

Other than the number of lanes, the maneuver and weaving length is the primary variable affecting the capacity of the freeway. Weaving (generally the crossing of diverging with merging traffic) is inherent in some types of interchanges such as the cloverleaf, but it is also produced by closely spaced interchanges of all types. Consequently, the minimum length required for maneuvering and weaving (based on the volume and pattern of through, entering and leaving traffic) will determine the minimum spacing for interchanges within certain constraints.

The minimum spacing of interchanges will also be limited by sufficient space for turning roadways, sufficient length for proper entrances and exits, sufficient length for the accommodation of the volumes entering and leaving, and sufficient length for signing. The driver must have sufficient time to read, comprehend, and act on the messages about exits. Based on maneuver and weaving lengths, the distances of 1800', 2600' and 4200' were considered guides for the absolute, normal and preferable minimum spacings for interchanges on urban freeways.<sup>51</sup> Based on user benefits, the optimum spacing for interchanges in urban areas ranged from two miles to one-half mile due to the sensitivity of user time costs and interest rates.<sup>52</sup>

Special Considerations. Federal and State policies and regulations are special considerations in the location and spacing of Interstate interchanges. Federal guidelines on the location of interchanges offer the State great latitude as evidenced by the following statement:





"In general, the Interstate highway should be provided with access connections to all, other than minor, crossroads at which there will be sufficient turning traffic to justify the construction of ramps. There are no guide traffic volume criteria in this regard, but it can be expected that Interstate interchanges in rural areas will be more frequent than on expressways and toll roads built thus far. On the other hand, access connections will not be in order on many minor crossroads. Sufficient interchanges should be provided to reasonably integrate with the local road system but only to the extent that the freeway character of operation can be maintained".<sup>53</sup>

The Federal guidelines recommended that interchanges be placed only at the trunk routes entering or bypassing small urban areas, that interchanges be located only at the principal arterials in intermediate to large urban areas, and that interchange locations be governed by the physical limitations of freeway geometrics and operations in and near the central area of large cities.

In reference to interchange spacing, interchanges were to be located "so as to properly discharge and receive traffic from other Interstate and Federal-aid system routes, or major arterials, highways or streets".<sup>54</sup> However, the interchanges were not to be spaced so closely "as to unnecessarily increase the cost of the System or interfere with the free flow and safety of traffic on the Interstate System".<sup>55</sup> Consequently, Federal guidelines established an average interchange spacing of two miles on urban sections, four miles on suburban sections and eight miles on rural sections and a minimum spacing of one mile on urban sections, two miles on suburban sections (not specifically stated) and three miles on rural sections. The urban suburban and suburban-rural boundaries of the design year determined the applicable guidelines. When an interchange fell below the stated averages and minimums or if the benefit-cost ratio for an interchange was less than one, the State had to submit justification for the interchange.



Indiana generally located interchanges at Federal and State highways, major county roads that would serve present and future users, and major arterials recommended by local transportation plans that intersected the Interstate System. The interchange spacing requirements prescribed by the Instructional Manual for the Preparation and Submission of Estimate of the Cost of Completing the Interstate System were used only as guidelines by Indiana. Indiana felt that interchange location and spacing had to be warranted by need in the local area and design considerations.

Although the average spacing of interchanges in rural sections of the Interstate System in Indiana approximates the Federal eight-mile average requirement, Indiana interchange spacings range from fifteen miles to slightly less than three miles apart because of the location of major highways. Since Interstate 64 passed through an area of little development, rough terrain and few crossroads, the average spacing of the interchanges could have been far above eight miles when based only on the character of intersecting highways; however, in the final design, the number of interchanges was increased to approach the eight-mile guideline to provide adequate service to the corridor area.

Indiana followed the Federal guidelines for the spacing of interchanges in suburban and urban areas with a few exceptions. The West Leg of Interstate 465 has an average interchange spacing close to a mile. Because the West and South legs of Interstate 465 had almost reached their design capacity in 1972, the Indiana State Highway Commission now believes that the one mile minimum spacing guidelines appear too low. However, Indiana has not as yet had to remove interchange ramps to keep a facility operational because the interchanges later proved to be too closely spaced. In the distant future, Indianapolis might have to meter traffic on to freeways like other metropolitan areas of today. Interchange spacing on the Indiana Interstate System is recorded in Table 10, pg. 223.





TABLE 10. INTERCHANGE AND SEPARATION SPACING

(IN MILES)

Route (a)	Spacing	Interchange Spacing			Seperation Spacing		
		average (b)	maximum	minimum	average	maximum	minimum
I 64 rural		7.20	14.34	1.69	2.36	6.46	0.20
New Albany		2.00	2.09	1.09	0.86	2.09	0.30
I 65 S rural		5.23	10.10	1.26	1.62	3.47	0.32
Jeffersonville		0.70	1.75	0.22(c)	0.34	1.25	0.09
Indianapolis		1.11	2.84	0.20(c)	0.35	1.25	0.09
I 65 N rural		6.06	14.69	0.68	1.73	4.35	0.28
Lebanon		1.24	1.32	1.16	1.24	1.32	1.16
Lafayette		—	—	—	1.13	1.58	0.77
Gary		2.24	2.86	1.63	1.04	2.48	0.24
I 69 rural		5.09	10.75	0.57	1.53	3.46	0.28
Indianapolis		1.29	1.74	0.84	1.29	1.74	0.84
Anderson		3.84	3.84	3.84	0.70	0.81	0.63
Fort Wayne		1.45	1.60	1.30	0.90	1.60	0.50
I 70 W rural		7.48	11.50	3.42	1.78	3.07	0.60
Terre Haute		4.34	4.34	4.34	0.62	0.84	0.39
Indianapolis		1.36	5.15	0.20(c)	0.43	2.00	0.02
I 70 E rural		7.51	12.16	2.16	1.61	3.00	0.36
I 74 W rural		6.103	12.59	3.42	1.75	3.23	0.31
Indianapolis		2.76	2.99	2.53	1.04	1.64	0.37
I 74 E rural		5.301	9.20	1.78	1.88	4.22	0.11
Tri-State rural		5.25	8.58	3.46	1.38	2.49	0.32
urban		1.79	2.78	0.76	0.66	2.46	0.17
Toll Road		11.90	28.60	3.20	1.05	3.00	20.75
I 265 rural		3.60	3.60	3.60	1.80	2.01	1.59
urban		3.14	3.14	3.14	0.79	1.84	0.52
I 275 rural		9.00	—	—	5.00	—	0.50
I 465 rural		2.52	3.90	0.78	0.92	1.50	0.72
urban		1.67	2.85	0.36	0.70	2.10	0.18

(a) RURAL-URBAN CLASSIFICATION BASED ON 1972 ESTIMATE OF THE COST OF COMPLETING THE NATIONAL SYSTEM OF INTERSTATE AND DEFENSE HIGHWAYS IN THE STATE OF INDIANA.

(b) AVERAGE INTERCHANGE SPACING FALLS BELOW THE AVERAGE SPACING GUIDELINES BECAUSE ADDITIONAL INTERCHANGES WERE JUSTIFIED REDUCING THE AVERAGE AND THE SUBURBAN AREA CLASSIFICATION OVERLAPS THE RURAL CLASSIFICATION.

(c) DISTANCE BETWEEN RAMP GORES OF ADJACENT INTERCHANGES.



Interchange Justification. Interchanges must all be justified to some degree. The extent of justification depends on whether the interchange was or was not in the originally approved design plan and on whether the interchange follows guidelines or not. When a State recommends an interchange that was not in the originally approved design plan, or that reduces the minimum and average spacing below the Federal guidelines or that falls below the minimum benefit-cost ratio value of one, the State must provide additional justification as to the public benefit and need of such an interchange.

As the Interstate Program progressed, the interchange justification process became more sophisticated through experience and new knowledge. As the ultimate cost of the Interstate System continued to rise, it became obvious that the cost of the System would have to be limited if the Interstate System was to be completed with the revenues from the Federal Highway Trust Fund. Since the location or spacing of interchanges and separations was the most flexible element in the Interstate System, guidelines were placed on the spacing of interchanges in 1960. All interchanges under design in 1960 and 1961 had to be justified according to the spacing guidelines. As a result, Indiana had to defer the construction of some interchanges it considered necessary until the original system was completed.

The factors used to establish public benefit and need in the justification of interchange location and spacing included traffic usage, traffic service to the community and community benefits, traffic service to the highway users, and Federal guidelines. Traffic usage of the interchange was based on present and future traffic demands and was supported by road user cost reductions. The amount of traffic served by an interchange was the primary basis for the justification of all interchanges because the interchange



was the only means of getting on and off of the facility. It was not always possible to justify interchanges merely on the basis of low traffic usage as was the case for some interchanges on Interstate 64. Interchanges must be spaced close enough to serve the community because the utility of the Interstate System to the community depends on adequate access.

Adequate access to the community yields social and economic benefits both for the present and future such as shorter commuting times, a greater area from which to draw labor and consumers, shorter travel times for goods, increased attractiveness for commerce and industry, and improved emergency services. There must be sufficient points of exit and entrance to the Interstate System so that the highway user can get his vehicle serviced and so that emergency vehicles can enter the facility in case of an accident or other emergency. When interchange spacing exceeded the average, the Federal guidelines were used by Indiana as partial justification for an additional interchange from the standpoint of service.

In addition to the information demonstrating public benefit and need for an interchange, the Federal Highway Administration has required the following information since 1965:

- 1) "A statement of the type and condition of the crossroad including:
  - a) The system or regional plan of which it is a part.
  - b) Average daily traffic, current and design year; through and turning.
  - c) Number of existing traffic lanes and type of highway.
  - d) Probable number of traffic lanes for the design year.
  - e) Distance to and size of communities directly served.
  - f) Distances to the next interchange in each direction.





- 2) An analysis of the crossroads, the other roads and streets in the area, and the relation of the interchange to them and to other interchanges to assure the ability of the said streets and roads to efficiently collect and distribute Interstate highway traffic.
- 3) The relationship of the interchange to adjacent interchanges of the Interstate highway and the possible interference with the operation of traffic on the Interstate by providing the interchange.
- 4) The existence of other roads or streets, or the probability of developing them, generally parallel to the Interstate System, which could be used by Interstate highway traffic by way of interchanges other than the one under consideration in traveling to and from its origin or destination.
- 5) A statement of the cost resulting from construction of the interchange, together with the estimated benefit-cost ratio for the additional work involved.
- 6) A special case where the interchange is clearly necessary to serve a compelling public need."<sup>56</sup>

The same factors were used to justify interchanges which fell below the Federal average and minimum spacing guidelines and interchanges which were additions to completed sections of Interstate. The Indiana State Highway Commission has been successful in justifying all interchanges requested that fell below the Federal average spacing requirements. Interchanges may be added to an approved access control strip map of the Interstate System Cost Estimate until the final plans, specifications and estimates for the project have been approved by the Division Engineer of the Federal Highway Administration. After such approval additional interchanges are not eligible for Federal Aid Interstate fund participation. This Federal policy is based on the fact that the Interstate Program was to be completed within a fixed time span. Other Federal aid highway programs are continuous in nature, and, as such, the Federal Highway Administration allows the addition of extra services under such programs.



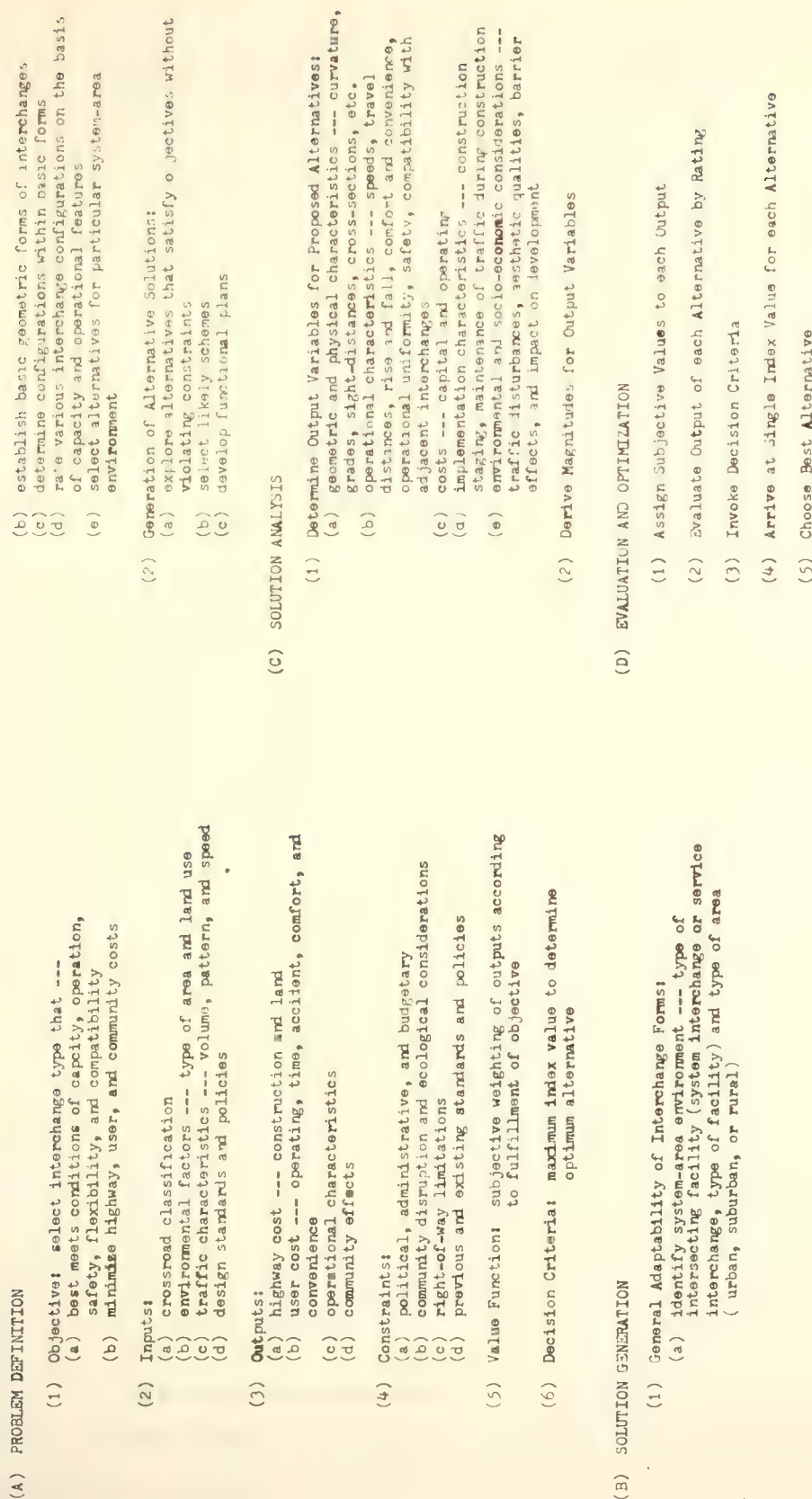
Since September of 1964, the Federal Highway Administration has become more lenient in approving interchanges after the route has been constructed. Originally, no additional interchange on a completed project was approved regardless of the source of funding. Now, additional interchanges may be added to the completed sections of Interstate if they are justified and approved through the same procedure that applies to interchange justification before final design approval; however, interchanges of such a nature are approved provided other than Federal Aid Interstate funds are used for construction and additional right-of-way costs.

With the change in policy, Indiana obtained Federal approval in 1965 for the addition of four interchanges to completed sections of the Interstate System with other than Federal Aid Interstate Funds. These additions include interchanges at Clark-Scott County Line Road for Underwood on Interstate 65, at SR 103 for Lewistown and New Castle on Interstate 70, at SR 341 for Hillsboro and at Porter Road (FAS-585) for New Ross on Interstate 74.

Selection of Interchange Type. Because the interchange is the most important feature of the freeway, the proper selection of the interchange type is the most important step in design. [Refer to Figure 24 , p. 228 ]. The objective is to determine the type of interchange that best satisfies the conditions of adequate capacity, efficient and uniform operation, adequate level of service, safety, sufficient flexibility to permit future adjustments and expansions, and compatibility of the freeway and local street system. Furthermore, the interchange type which best meets these conditions should minimize highway costs (right-of-way and construction), highway user costs (vehicle operation, time, accident and inconvenience), and community costs (adverse effects on the community).





FIGURE 24. INTERCHANGE TYPE SELECTION PROCESS<sup>57</sup>



"In urban areas the problem is primarily to provide adequate capacity and efficient operation. Wherever possible, the design should be sufficiently flexible to permit future adjustments and expansion. In rural areas the problem is generally to adopt interchange arrangements in keeping with the character of intersecting highways." 58

The type and character of the intersecting highway and the intensity of development of the area adjacent to the interchange are interrelated considerations in selecting the appropriate interchange type. The Indiana State Highway Commission does not have a rigid policy that states a particular type of interchange form will be utilized for a particular highway system or type of area. However, the Indiana State Highway Commission has a preference for the diamond interchange form particularly in rural areas and, to a certain extent, in urban areas where the cost and amount of right-of-way required must be minimized due to intense land use. The versatility and low cost of the diamond interchange explains this preference. The partial-cloverleaf (parclo) interchange was utilized by Indiana where natural barriers prohibited the use of the diamond or other forms of interchanges. For high volume suburban and urban highways, the Indiana State Highway Commission used the basic cloverleaf unless directional ramps were dictated by turning movements. Nevertheless, in selecting the form of interchange for a particular location, the type of intersecting highway and area was first determined and then the appropriate forms of interchanges examined. Consequently, there was a relationship between the type of intersecting highway and area and the form of interchange considered appropriate.

The diamond interchange was considered the most suitable form of interchange on the Interstate when the intersecting highway was a minor road in any area, a primary highway in



a rural or suburban area, or a major street in an urban area. The diamond interchange provided high speed exits and entrances to the Interstate and occupied little additional space beyond that needed for the intersecting facility. The obvious advantage of the diamond interchange was the low highway cost (\$750,000 in 1972 for construction and right-of-way) since little right-of-way was required (ten acres in urban areas and fifteen to twenty acres in rural areas) and little pavement was required compared to more elaborate forms. In turn, low land requirements meant little adverse effect on the community through the loss of land or displacement. Because of simplicity of design and signing, the diamond interchange was considered well adapted to vehicle operations on urban or rural street systems.

The major disadvantage of the diamond interchange was that it did not provide free flow for turning maneuvers and required signals on the intersecting highway when it carried high volumes. The diamond interchange was not considered by the Indiana State Highway Commission to be more conducive to wrong way maneuvers than other interchange forms. Indiana has utilized median barriers and channelization on many diamond interchanges which generally reduces the problem of wrong way maneuvers. The Federal Highway Administration considered safety sufficient criteria in itself to add these features.

Because of conflicts between through and turning vehicles on the crossroad, the low radii flare on ramp entrances from the crossroad and the stops on ramps and possibly the crossroad if signalized, the diamond interchange was generally considered incompatible with the high speed, continuous movement characteristics for primary rural intersecting highways. However, Indiana considered the diamond interchange suitable for primary rural crossroads because the primary rural highways of Indiana, State Route and





United States Route designations, lacked the volume necessary to justify higher type interchanges and because continuous movement characteristics were not exhibited by most primary rural highways in Indiana due to numerous at-grade signalized intersections.

In the past, Indiana designed diamond interchanges with flared entrance ramps. However, the large maneuver area of the flared diamond resulted in a high accident rate because drivers were not sure where to turn into the entrance ramps or when to yield to left turning vehicles. This knowledge led to Federal discouragement of flared entrance ramps on diamond interchanges. The diamond interchanges in Indiana have been designed for possible signalization at the ramp terminals of the crossroad. In such a case, the flared diamond was inappropriate because it was not compatible with signalization.

The popularity of the diamond interchange for the Interstate System was due to its low cost, simplicity of design, compatibility with low to medium volume crossroads of non-continuous flow, and flexibility. The diamond interchange may be split with half the interchange at one crossroad and half at an adjacent crossroad with or without connector roads. This split-diamond interchange is used when other designs would create weaving problems due to the proximity of ramps or when greater interchange capacity is needed. Indiana has generally used the split diamond with connector roads in confined urban areas. When a diamond interchange is properly signalized, it often has a higher capacity than a tight cloverleaf.

The cloverleaf was once considered the most suitable form of interchange on the Interstate when the intersecting highway was a primary highway in suburban areas. The cloverleaf interchange has free flow characteristics enabling continuous movement on the crossroad. However,



operational problems due to weaving led to a deemphasis of the use of cloverleaf. The short weaving distances between the inner loops (the entrance and exit ramps) caused the accelerating and decelerating traffic to be in constant conflict. The tight curves had a design speed of 35 mph, a short merge distance, and a poor field of vision on the curve because the point of acceleration was beyond the point where through traffic could be seen. The tight loops caused acceleration and deceleration problems particularly for trucks. These limitations made the cloverleaf a dangerous interchange design. The cloverleaf was an expensive interchange (\$1,500,000 in 1972 for construction and right-of-way) and required a large area (thirty-five to fifty acres) which implied greater displacement and loss of land in more densely developed areas.

The deemphasis of the cloverleaf interchange came in 1960 when the rising cost of the Interstate prompted the accusation that engineers were gold-plating the Interstate System. With new experience on the capacity characteristics of interchanges and greater recognition of safety, the cloverleaf interchange was often replaced by the diamond interchange; it could move more traffic through the ramp intersections with the crossroad if properly signalized and was safer due to longer merge distances, a better field of vision and no weaving. To make the cloverleaf interchange function properly for high volume continuous flow highways, it was necessary to spread the interchange out farther or to separate the through traffic from the weaving traffic by using collector-distributor roads. With such increases in highway cost, the designer might as well go to a directional interchange.





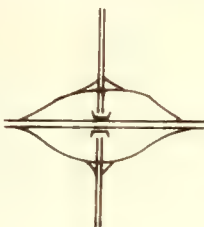
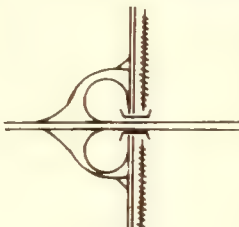
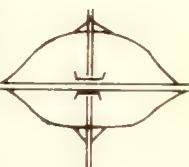
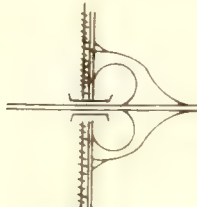


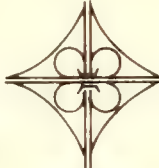
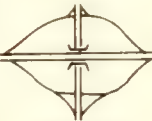

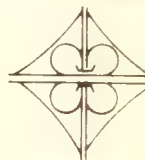


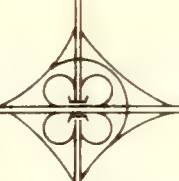
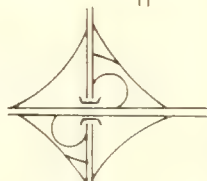

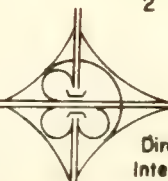

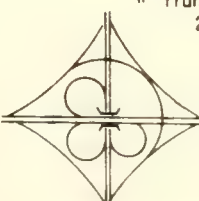
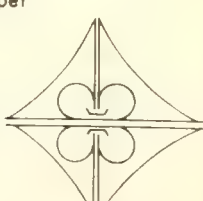
The partial cloverleaf (parclo) type interchange has been used by Indiana where natural barriers such as railroads streams, or developments have precluded the diamond interchange. The land required and the cost of the parclo interchange falls between that of the diamond and cloverleaf interchanges. The loops of the parclo-A interchange are located in advance of the overpass; the loops of the parclo-B interchange are located beyond the overpass; and both loops of the Parclo-AB interchange are located on one side of the overpass. The parclo-A (4-quad), a parclo-A interchange with directional ramps in the quadrants opposite the quadrants with loops, eliminates left turns from the crossroad. The parclo-A or B (4-quad) interchanges may handle greater capacities than the cloverleaf because there are no weaving conflicts between the loops. However, the parclo (4-quad) does not generally have more capacity than a properly signalized diamond interchange.

Where the Interstate route intersects another Interstate route, freeway or expressway, the most suitable form of interchange is the free flow type. The general policy in Indiana has been to start with the basic cloverleaf interchange and modify it with directional ramps for high volume turns. When loops remained in the final design, Indiana preferred the use of only two loops which were diagonally opposite so that weaving problems were not created between the loops. The free flow type interchanges provide the best operational characteristics but are the most costly interchanges requiring forty to seventy acres. Table 11 (p. 234) classifies the types of interchanges on the Indiana Interstate System by the character of the crossroad and type of land development.

Beside the character of the intersecting highway and the intensity of development in the area, the traffic patterns in the area must be considered in the selection of



TABLE II. INTERCHANGE CLASSIFICATION

Type of Intersecting Facility	Type of Area <sup>(a)</sup>					
	Rural	Suburban	Urban			
Local Road or Minor Street	 Diamond 83	 Parclo AB 11	 Diamond 7	 Parclo AB 4		
Primary Highway or Major Street (≥5000 ADT)	 Diamond 19	 Trumpet 2	 Cloverleaf 7	 Diamond 32	 Trumpet 3	 Cloverleaf 11
	 Directional Interchange 4	 Parclo B 22	 Directional Interchange 6	 Parclo B 11		
Freeway	 Trumpet 2	 Directional Interchange 3	 Trumpet 2	 Directional Interchange 9	 Cloverleaf 2	

(a) Rural-Urban classification based on 1972 Estimate of the Cost of Completing the National System of Interstate and Defense Highways in the state of Indiana



the form of interchange. The volumes of through and turning movements determine the general forms of interchanges considered appropriate, the type of ramps needed (loop versus directional), the placement of ramps, and the type of signalization required. The location and types of ramps were particularly important in restricted urban areas where land use, land value, one-way streets, the local traffic circulation pattern and proximity of interchanges limit the alternatives.

The land use and land value were as important in selecting the interchange type as in locating the interchange. Public and quasi-public land uses and other types of development were to be avoided in selecting and designing the interchange form because of the adverse affect on the community and the high cost of right-of-way. When heavy development was in a particular quadrant of the interchange, a variation of the parclo interchange was used. Intense development often required the use of a tight diamond to minimize the land acquired.

The proximity of other interchanges affects the choice of interchange types because of operating characteristics such as signing and weaving distances. In restricted urban areas, the minimum signing, weaving and maneuver distances often defined the location of ramp entrances and exits and, in turn, defined the form of interchange that could be used.

The effect of other transportation facilities or natural barriers must be considered in selecting the form of interchange. A railroad or stream closely paralleling an Interstate or a crossroad often dictated the use of the parclo-AB interchange. Rough topography and the vertical and horizontal alignment of the Interstate or crossroad have influenced the type of interchange selected in some cases because of limitations on the placement of ramps.





The effect of the proximity of other roads must also be considered in selecting the type of interchange. As in interchange location, the ability of the local street system to collect and distribute traffic affects the choice of interchange type. If local streets parallel the Interstate, the location of ramps on the crossroad becomes a problem because of the proximity of the ramp intersections on the crossroads with other intersections on the crossroad. Unless a collector-distributor road is used, the short distances between intersections on the crossroad make the cloverleaf interchange unworkable because of inadequate weaving distances. The close proximity of intersections on the crossroad necessitates special consideration of the crossroad design to insure adequate lanes for turning vehicles and vehicle storage at the intersections and ramp entrances or exits.

Interchange Design and Special Considerations. In the design of the interchange, Indiana closely followed the AASHO design procedures recommended by A Policy on the Geometric Design of Rural Highways and A Policy on Arterial Highways in Urban Areas. The basic data required for interchange design included traffic data for the design year for all through and turning movements, physical data such as topography and development for the present and future, and characteristics of all highways and development existing or planned that may affect the design. The interchange design in Indiana was based on the 30th highest design hour volume, whether it was in the morning or evening. Traffic assignments were made for the morning and evening peak hours for capacity studies in detailed ramp design. The Indiana State Highway Commission closely followed the Highway Capacity Manual as a guide for capacity values for interchange types and interchange elements, especially at capacity restrictions such as at-grade intersections on



diamond interchanges and weaving maneuvers. The alternate designs were evaluated on the basis of highway cost including right-of-way, construction, suitability for stage construction and maintenance; user cost including vehicle operating and time costs, safety features of design, level of service as reflected by capacity, volume and operational characteristics and maintenance of traffic during construction; and community impact.

During the selection and design of interchanges, the uniformity of the operational pattern of interchanges must be considered because of driver expectation. If a driver has encountered numerous diamond interchanges on the route, he expects to make a right hand exit to the crossroad and to decide at the crossroad if he wants to go right or left; if the driver encounters a cloverleaf interchange, he has to unexpectedly make two decisions at once which leads to confusion. To insure uniformity of the operational pattern would require the costly addition of collector-distributor roads to the cloverleaf. Unless collector-distributor roads can be justified through traffic volumes, the cost was considered prohibitive by Indiana.

For the reason of driver expectation, the right hand exit and entrance policy has been used in Indiana except where geographic features or excessive cost made the left hand exit and entrance necessary. There are few right hand and left hand exits which are in close proximity in Indiana excluding the forks of Interstate Routes. Indiana also follows a policy of providing for all movements at interchanges, particularly in rural areas.

In the design of ramps, there has been a continual evolution in cross section design. At the beginning of the Interstate Program, the ramps were eighteen feet wide with unstabilized shoulders and curbs on some curves. The design went to all curbs; and later in the Program, the





curbs were eliminated. The current ramp cross section is thirty-four feet (a sixteen foot travel lane, a seven-foot stabilized left shoulder with 2'-6" paved and an eleven-foot stabilized right shoulder with 6'-6" paved) based on a single traffic lane and the ability of traffic to pass a stalled vehicle.

The design of acceleration and deceleration lanes as an element of the interchange has evolved over time. Prior to the Interstate Program, such lanes were often non-existent creating a slowing down of traffic, when traffic exited, and a difficult merge. Even though the need for adequate lanes was generally recognized at the beginning of the Interstate Program, adequate deceleration and acceleration lanes of 1000' to 1050' were only eligible for funding after 1960. Prior to 1960, only 500' (250' parallel and 250' taper) lanes were eligible for funding. These deceleration lanes were so short that traffic slowed down on the through lanes or decelerated on the ramp as if it was a deceleration lane. Interchanges exhibiting the older design criteria still exist on older segments of Interstate 65.

### Other Design Features

Evolution of the Separation. The separation of crossroads is needed to maintain circulation on the local road system. In locating and spacing separations, Indiana considered the continuity and character of the crossroad, the volume of the crossroad and the community service needs.

In the rural area, the length of the crossroad (continuity) and type of facility (type of surface and type of system) were important in determining the location of separations. The longer the county road, the higher the type of surface and the greater the possibility of Federal funding, the more important the county road probably was to the local



circulation system. A county road with these characteristics could more readily handle additional traffic (diverted from closed roads) or could be easily improved to handle such traffic.

In urban areas, the separations were located at intersecting arterials and major collectors because of their greater importance in the street circulation system due to their greater width, continuity, and through traffic service.

Indiana does not have separation warrants based on set crossroad volume. However, the crossroad volume is an indicator of the importance of the crossroad to the community and the highway user. If the crossroad volume is too low (roughly below 100 vehicles per day), the savings in road user cost will not offset the cost of the separation (\$140,000 to \$225,000 with an average of \$170,000) within a reasonable period of time. Nevertheless, volume is only one consideration and separations have been built in Indiana at crossroads with low volumes because of community need or the need to maintain the traffic circulation pattern of the area.

The spacing of separations depends on the local circulation pattern and street pattern. The separations must be sufficient in number and size to accommodate existing traffic, traffic diverted from closed roads or streets and traffic generated by new development. In addition to maintaining local circulation, the separations are necessary for community services such as fire and police protection, other emergency vehicles, schools and other important public institutions, transit operations, access for vehicles or pedestrians to transportation terminals or stations, and heavy pedestrian movement.

In rural areas, Indiana considered an average separation spacing of two miles adequate to maintain local circulation. In urban areas, the average separation spacing varies from





one mile down to a quarter of mile in central business districts. Refer to Table 11 ( p. 234 ) for separation spacing in Indiana.

The justification of separations has always depended on the volume of cross traffic and the areas to be served. The volume of traffic used in the economic analysis is based on the projection of present traffic trends. To economically justify the separation, the road user savings must amortize the cost of the separation by the design year (twenty years). When the benefit-cost ratio was used to justify a separation prior to 1964, farm equipment movement between separated parcels was a factor in figuring road user cost in rural areas. Farm equipment movement is still considered although actual figures are not used.

The Federal Highway Administration has required the same extent of justification for separations over the life of the Interstate Program. Separation justification was generally required only when the separation was an addition to the access control map approved for the Interstate Cost Estimate. However, the economic constraints imposed by Congress in 1960 required the justification of all separations under design or not yet under construction in 1960 and 1961. Similar to the policy on interchanges, separations were not eligible for Federal Aid Interstate fund participation if they were additions to the originally approved construction plans (final plans, specifications and estimates); however, funding other than Interstate could be used to construct such separations. As the Interstate Program progressed, Indiana has required more separations for reasons of local circulation and service than were thought necessary in the early stages of the Program.

When the separation of an existing road was at a large skew angle, the criteria used to justify the relocation of the crossroad to reduce the skew angle was the higher cost





of the skewed bridge versus the character of the crossroad. The horizontal alignment of the Interstate or crossroad was considered in relation to the skew angle of the separation structure in the location process, especially in highly developed areas such as between 29th and 30th Streets in Indianapolis on Interstate 65.

For many years the Federal Highway Administration required a right angle crossing or a skew angle crossing no more than  $40^{\circ}$  from the perpendicular; Indiana considered crossroad relocation when the skew was greater than  $30^{\circ}$  from the perpendicular. As a result, there were many relocated crossroads that were built to less than desirable alignment to reduce the skew of crossing the Interstate. Although the Indiana State Highway Commission objected to the construction of "dog legs" into otherwise straight county roads, cost was the overriding factor. Later in the Interstate Program, greater skew angles were accepted to maintain the integrity of the alignment of the crossroad as much as possible.

Evolution of Road Closure. If every crossroad was separated, the cost of the Interstate System would have been prohibitive. On the other hand, the closure of a road has an adverse effect on some segment of the community. The crossroads which had no continuity, a low surface type, no available federal funding, low traffic usage and no compelling local need were proposed for closure. Indiana conducted studies of the usage of every proposed road closure even though this was not a Federal requirement.

Present average daily traffic usage was the primary indicator of the utility of the road to the community. However, if Indiana received positive information that the construction of a major generator was imminent and that the traffic usage of the road would increase, the information was considered in determining the disposition of the crossroad. When communities lacked transportation studies which



indicated the future development of the area and established a hierarchy of importance for the roads, the Indiana State Highway Commission could only base future use of a cross-road on current use trends. Even though these local governments were consulted during the Interstate planning stage as to their recommendations for road closure and separation, the local governments often lacked adequate data.

Evolution of the Frontage Road. The criteria utilized in determining the need for a frontage road included property access, continuity of the existing traffic pattern, traffic usage, and community need. The frontage road was originally intended as an alternative to the purchase of access rights. When Interstate routes were built on a new location, access rights were to be purchased to eliminate the general use of frontage roads. Frontage roads could be included in the design of an Interstate on a new location only if they reestablished the continuity of an existing highway system of roads intercepted by the Interstate or connected landlocked parcels to a public road. Since 1960, frontage roads were eligible for Interstate fund participation on Interstate routes on a new location if they reestablished the connection between two portions of property severed by the Interstate and were economically justified. Since 1970, frontage roads which provided or restored access to property were eligible for Federal Aid Interstate fund participation even if the Interstate route was on a new location.

Frontage roads were justified when the cost of damages due to landlocking offset the cost of constructing an access road or when the savings in road user costs offset the cost of the frontage road. Because all roads cannot be separated and the Interstate System cuts off access to property, frontage roads are needed to maintain continuity of the local circulation pattern or system by linking the





roads closed to those that were separated and to provide access to property isolated by the Interstate System.

Only present traffic usage can be used to justify a frontage road for maintaining the continuity of the local circulation system. Although potential land use and anticipated growth cannot be a justification, the Federal Highway Administration would probably approve frontage roads if there was compelling evidence of imminent future development in the area. Community service factors such as school access, bus and mail route continuity and property access for fire, police and ambulance service have been used to justify a frontage road in some instances even though the frontage road could not be justified by road user savings. As in the case of all access control features, the local governments were consulted for recommendations on frontage roads. Again a comprehensive land use plan or transportation plan provided a solid basis for decisions on the need for frontage roads.

Utilization of Collector-Distributor Roads. When interchanges or ramps are in close proximity, collector-distributor roads are used to remove weaving movements from the through lanes so as to provide the additional capacity that enables the closer spacing of interchanges and ramps. In highly developed urban areas, collector-distributor roads or continuous frontage roads on both sides provide great flexibility in accommodating the internal circulation pattern. Collector-distributor roads are justified on the basis of required capacity (as are through lanes) and the policy of balanced design.

The purpose of the collector-distributor road is to separate local traffic (merging and diverging traffic) from through traffic in order to provide a higher level of service for both types of traffic by providing more access points and higher speeds. The policy of balanced design states that



the number of lanes on the collector-distributor road for local traffic should not exceed the number of lanes for through traffic; otherwise the volume of through traffic does not warrant specialized treatment. If the number of lanes for both the main line and the collector-distributor exceeds the number of lanes required for the main line without the collector-distributor, the additional cost for the collector-distributor is questionable. Indiana has utilized collector-distributors where the close spacing of ramps or interchanges necessitated the need for additional capacity. Collector-distributor roads have been constructed on Interstate 65 in Jeffersonville, in Indianapolis along the East Leg of the Inner Loop and at 38th Street, and in northwest Lebanon at US 52; on Interstate 70 in Indianapolis along the South Leg of the Inner Loop; on Interstate 465 along the East Leg at 56th Street - Shadeland Avenue and along the West Leg at W. 10th Street; and on Interstate 69 at SR 67 - 32. Although Indiana has been considering the addition of a collector-distributor to a cloverleaf interchange on Interstate 94, collector-distributor roads have yet to be used to improve the operational characteristics of an existing cloverleaf interchange.

#### Federal and State Policy As It Affects Design

Federal Highway Administration policy on Federal Interstate Fund participation and Indiana policy on the expenditure of the Federal aid funds it receives have a direct bearing on the design alternatives that are feasible and the final alternative selected.

##### Policies on Grade Separated Crossroads Without Ramps.

The cost of adjusting or relocating a crossroad for a grade separation without ramps is eligible for Federal Aid Interstate participation. The crossroad may only be reconstructed to the standards of the system to which it belongs.





"The construction of grade separations for crossroads that are in existence at the time of construction of the Interstate highway or for new crossroads that are constructed concurrently with the Interstate highway, is an Interstate responsibility and costs thereof are eligible for Federal Aid Interstate participation to the limits described herein."<sup>59</sup>

Federal participation in the reconstruction of the crossroad is limited to the distance between the touchdown points where the new crossroad gradeline reaches the normal ground line on the grade of the existing crossroad as shown in Figure 25 (p. 246 ). If the touchdown points fall within the Interstate right-of-way, the cost of construction on the crossroad to the edge of the Interstate right-of-way is eligible for Federal Aid Interstate participation provided the crossroad is improved concurrently with other funds. [See Figure 26 (p. 247 )]. If the touchdown points are in close proximity to a street intersecting the crossroad, construction on the crossroad to the intersection is eligible for Federal Aid Interstate participation as shown in Figure 27 (p. 247 ).

When the crossroad profile design is governed by the necessity for a second structure over a railroad, stream or another highway adjacent to the Interstate, construction to the attainable touchdown point Y is the limit for Federal Aid Interstate participation. provided the second structure lies within the theoretical touchdown point X as in Figure 28 (p.248 ). If the second structure lies partly or a short distance beyond the theoretical touchdown down point X, Federal Aid Interstate participation is limited to a vertical plane passing through the theoretical touchdown point X or to a logical construction work limit a short distance from such point as shown in Figures 29, 30 and 31 (pgs. 248 and 249). The same policies are applicable to an overpass or underpass of the Interstate.





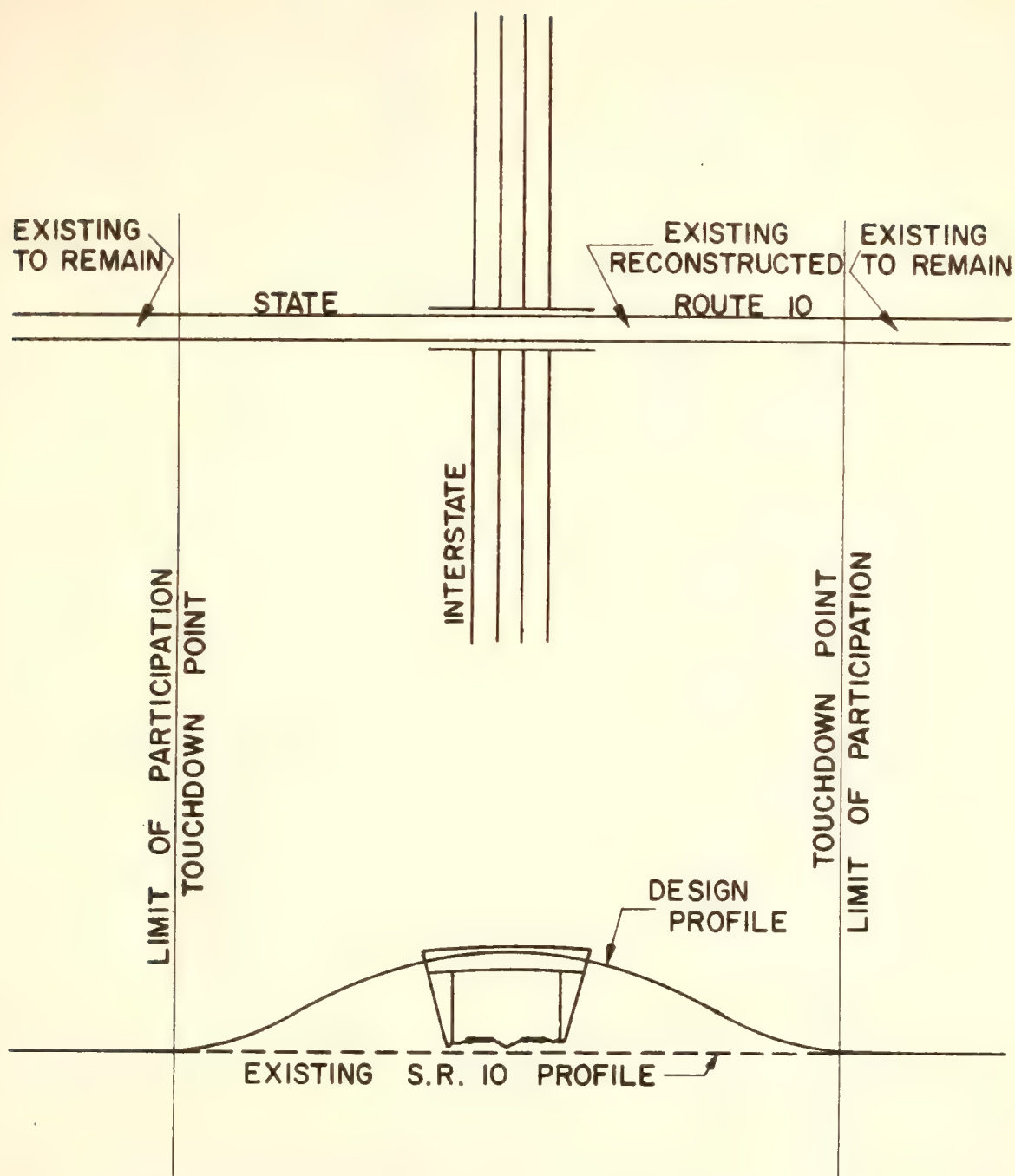


FIGURE 25. LIMIT OF FEDERAL PARTICIPATION<sup>60</sup>



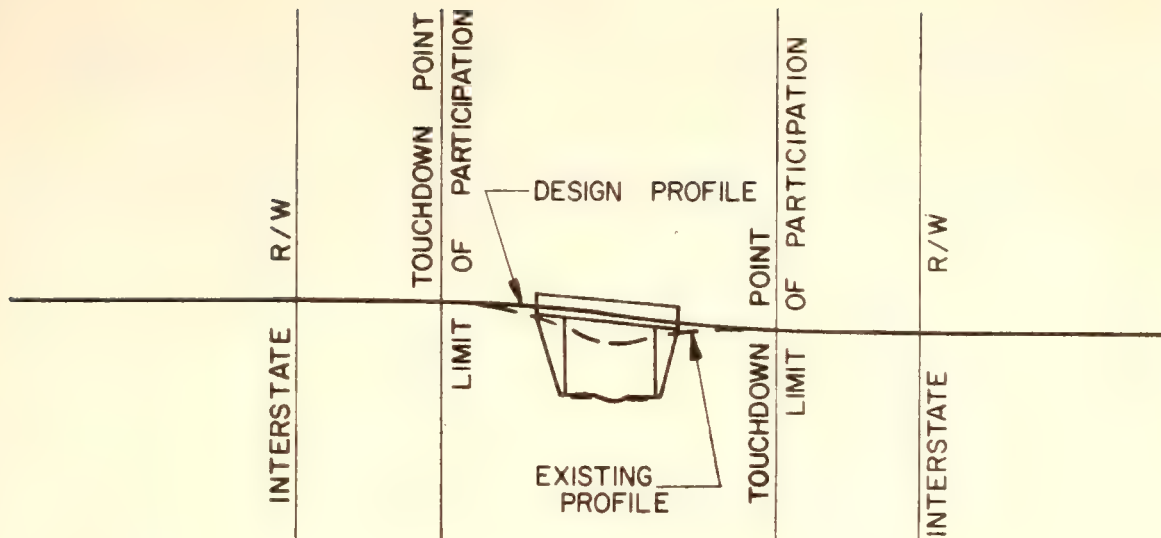


FIGURE 26. LIMIT OF FEDERAL PARTICIPATION<sup>61</sup>

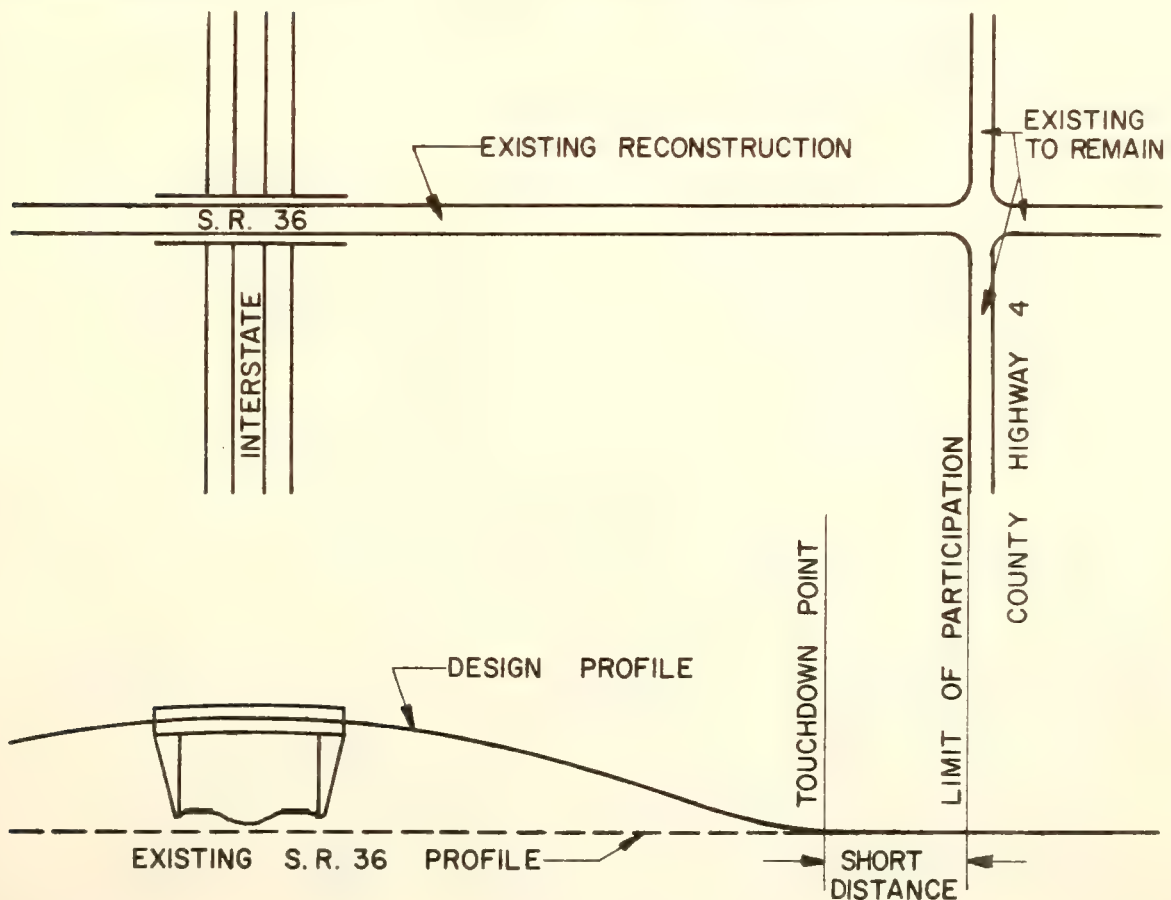
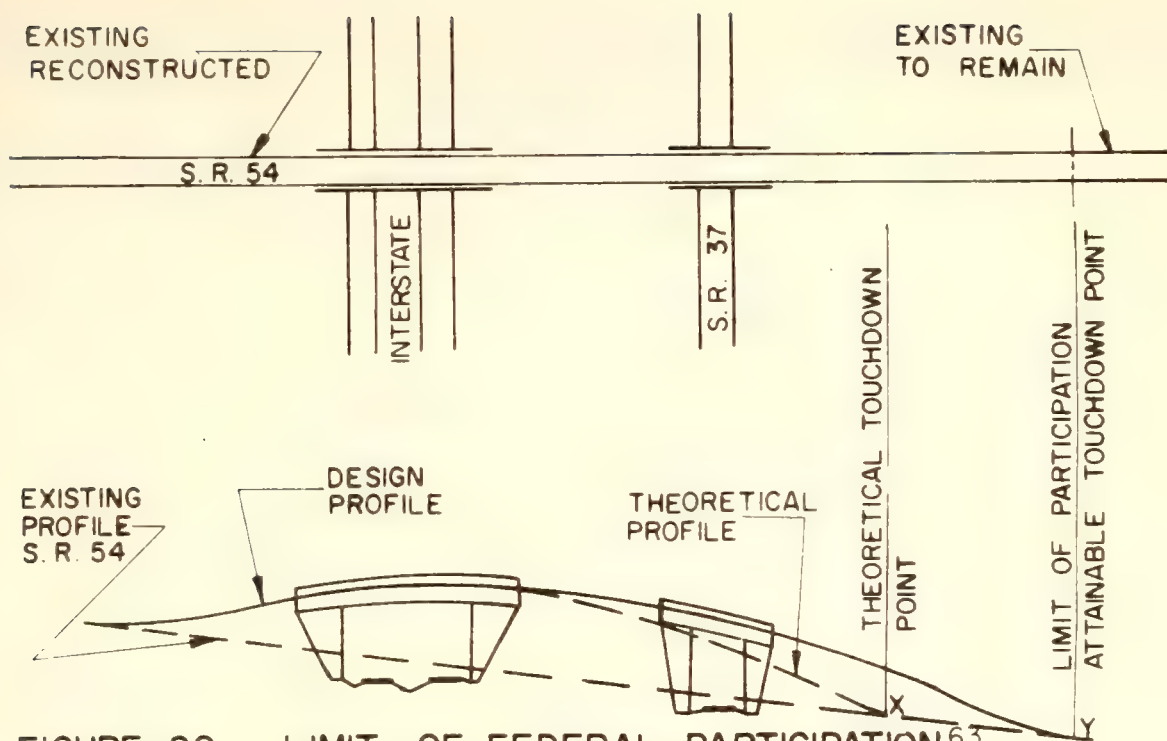
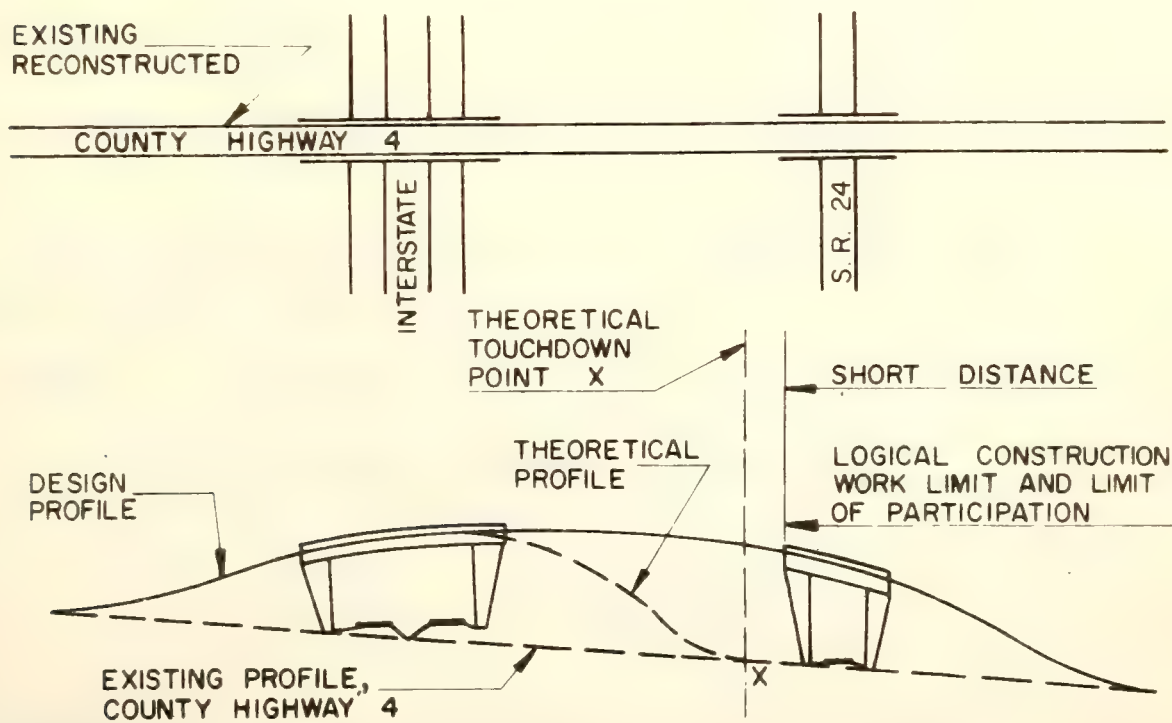


FIGURE 27. LIMIT OF FEDERAL PARTICIPATION<sup>62</sup>





FIGURE 28. LIMIT OF FEDERAL PARTICIPATION<sup>63</sup>FIGURE 29. LIMIT OF FEDERAL PARTICIPATION<sup>64</sup>



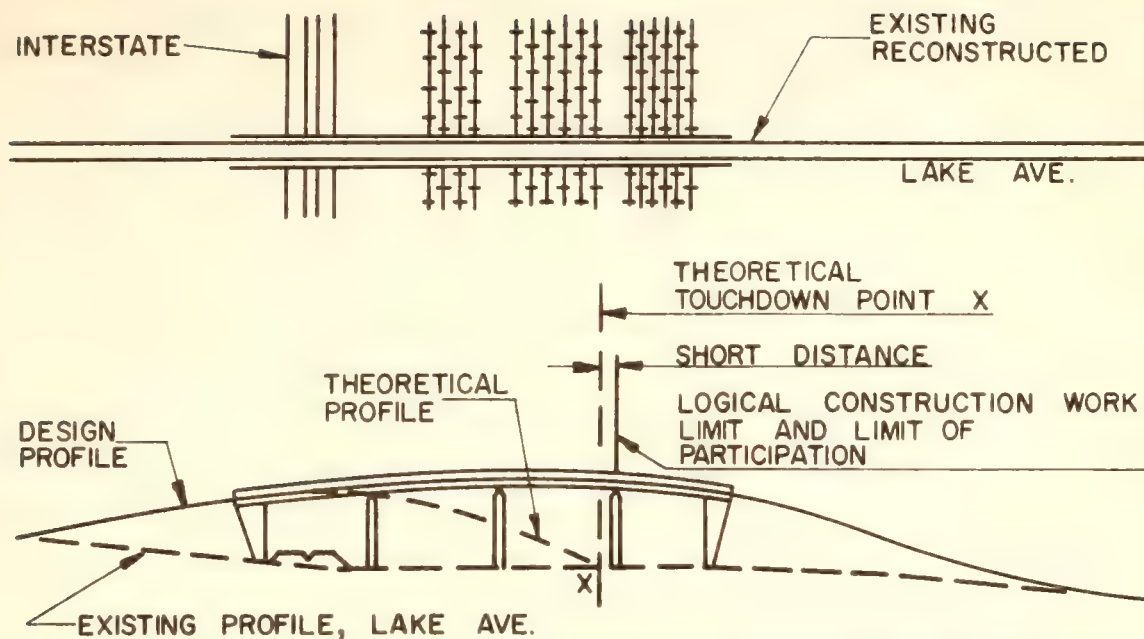


FIGURE 30. LIMIT OF FEDERAL PARTICIPATION<sup>65</sup>

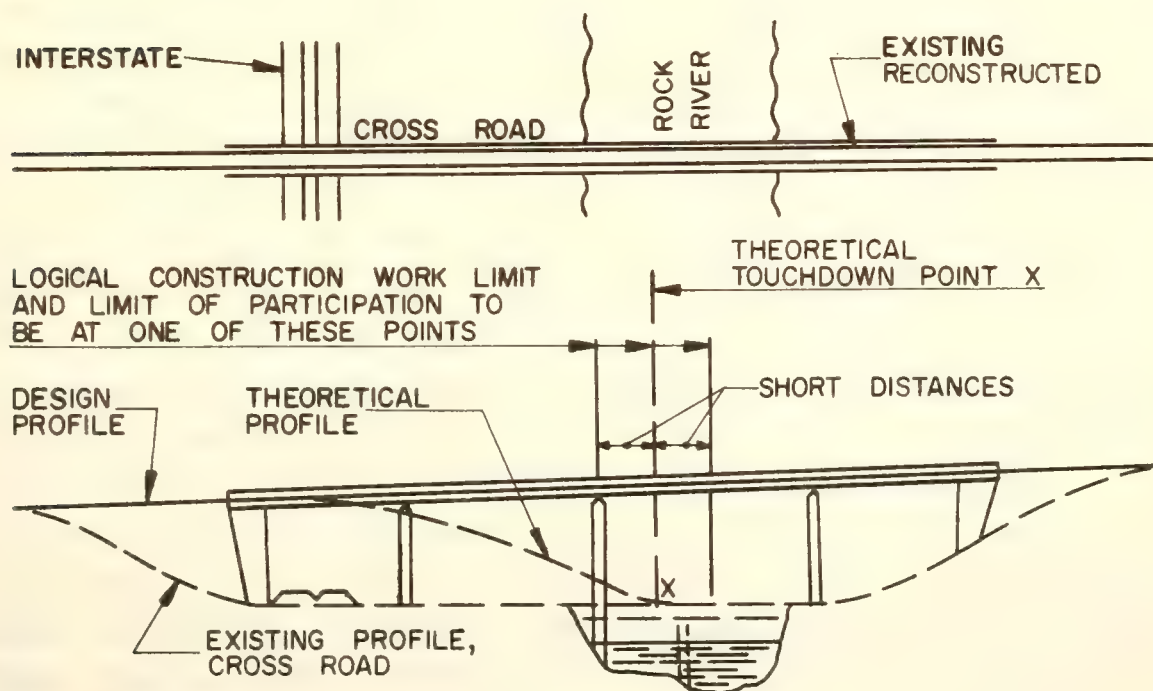


FIGURE 31. LIMIT OF FEDERAL PARTICIPATION<sup>66</sup>



"When a relocation (of the crossroad) provides traffic service reasonably comparable to the existing location and its construction is less costly, the crossroad work on the relocation, including acceptable at-grade intersections with the existing road, is eligible for Federal Aid Interstate participation [as shown in Figure 32 , p. 251 ]."<sup>67</sup>

If the relocated crossroad terminates at an intersection of an existing highway, Federal Aid Interstate participation is limited to work between the intersections of the existing highways such as between points X and Z in Figure 33 (p. 251 ). However, if the existing crossroad W-Z is of a higher type than the existing highway at which the relocated crossroad terminates, the cost of upgrading the portion of existing road between the old and new intersection with the crossroad, W-X, to the type of the crossroad is eligible for Federal Aid Interstate participation provided the cost of upgrading the existing highway and relocating the crossroad is less than cost at the existing location of the crossroad.

Federal Aid Interstate funds may only participate in the cost of constructing or restoring the existing number of lanes on the crossroad unless additional lanes could be justified in the imminent future. If the existing roadway did not meet the standards for its system, the cost of reconstructing the existing crossroad to the standards of its system with the same number of lanes is eligible for Federal Aid Interstate participation. If there is justification to improve the crossroad to a greater number of lanes in accordance with the standards of its system, Federal Aid Interstate funds may participate in the cost of the additional lanes within the touchdown points or to the end of the tapers where the new road ties into the existing road [as shown in Figure 34, p. 252 ], "provided there is concurrent work on a substantial length of the crossroad beyond the cited limits or there is a definite commitment to improve the crossroad





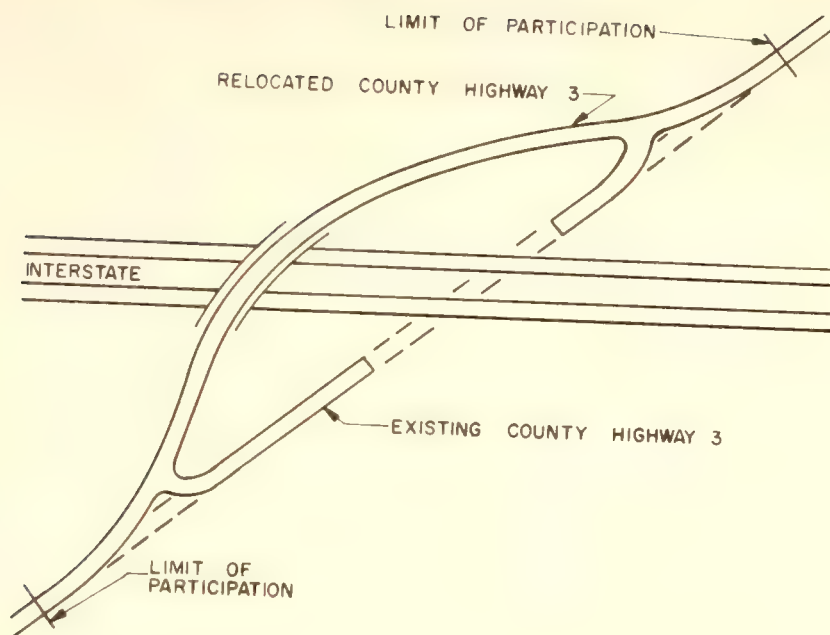


FIGURE 32. LIMIT OF FEDERAL PARTICIPATION  
FOR CROSSROAD RELOCATION<sup>68</sup>

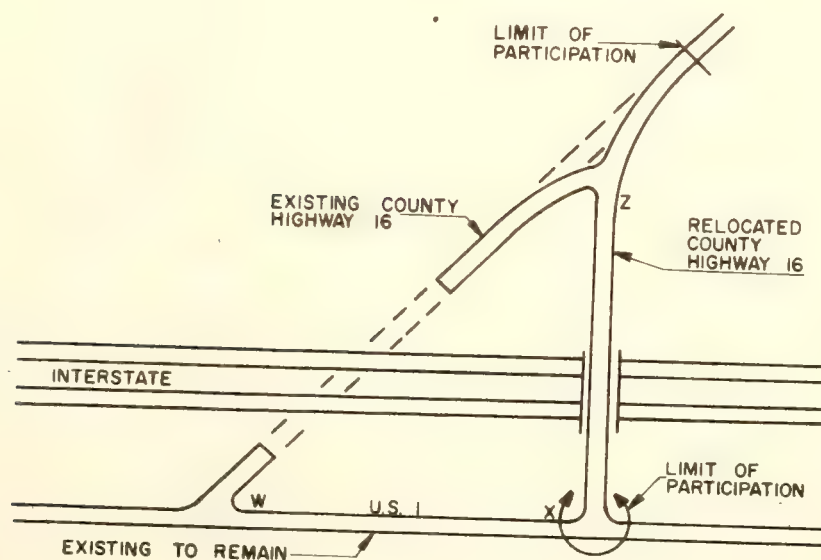


FIGURE 33. LIMIT OF FEDERAL PARTICIPATION  
FOR CROSSROAD RELOCATION<sup>69</sup>



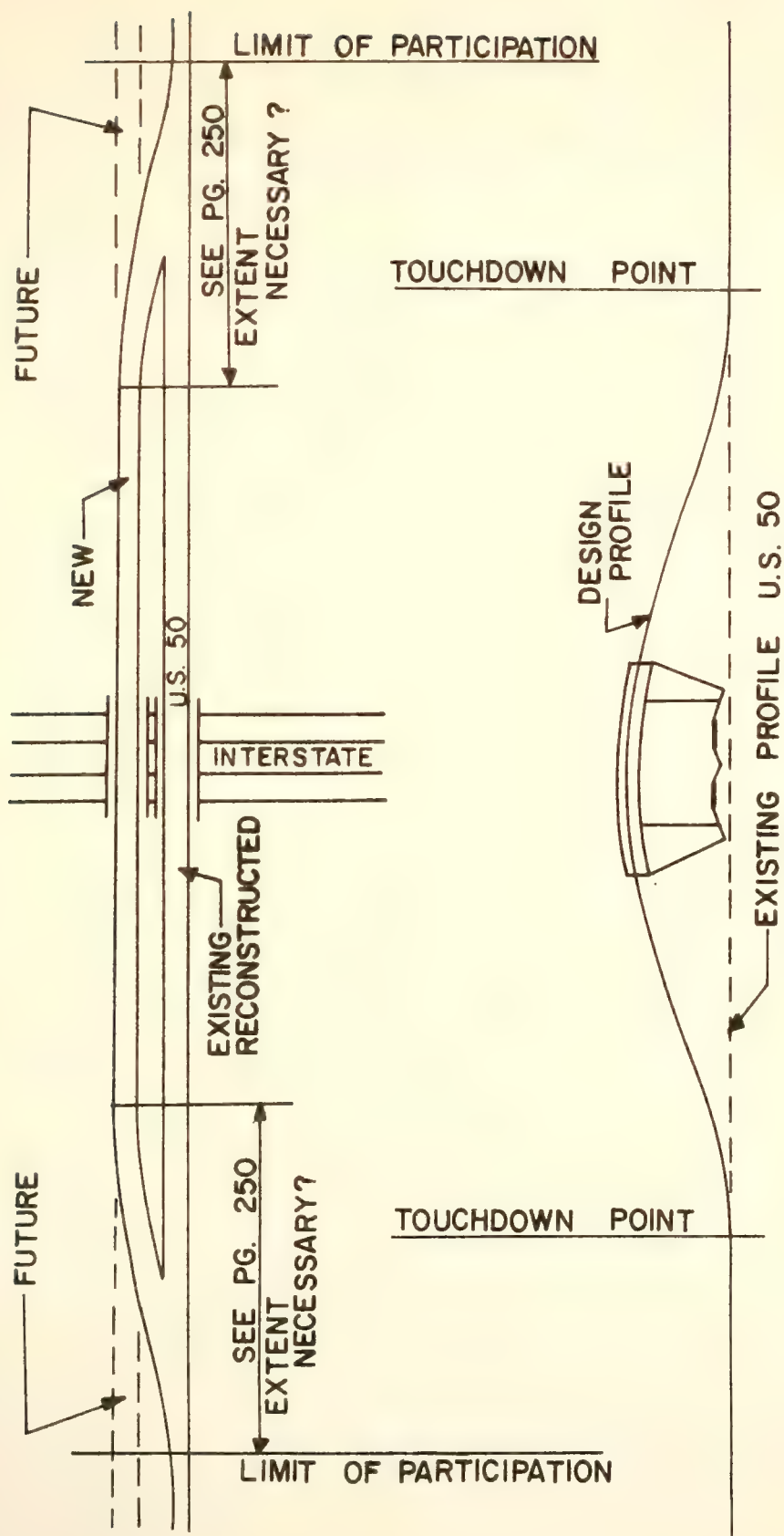


FIGURE 34. LIMIT OF FEDERAL PARTICIPATION<sup>70</sup>





beyond the cited limits to a greater number of lanes within 5 years of the time the Interstate highway construction is completed" (or within the life of the Interstate Program if less than five years).<sup>71</sup>

If the State wishes to improve the crossroad to a greater number of lanes than the existing roadway without concurrent work on the crossroad beyond the Federal Aid Interstate participation limits or without a definite commitment for such work, the cost of the separation and the crossroad in excess of the existing number of lanes is not eligible for Federal Aid Interstate participation. If the State justifies the additional lanes for the crossroad and makes a commitment to improve the crossroad currently or within five years, Federal Aid Interstate funds may participate in the extra width of the grade separation structure to accommodate the additional length of the Interstate structure to accommodate the additional lanes undercrossing the Interstate. When the additional lanes cannot be justified at present but planning indicates that the additional lanes will be justified in the future, the Interstate highway structure overcrossing the crossroad may be lengthened to provide minimum, not desirable, dimensions for the future number of lanes with Federal Aid Interstate participation.

The State justification for additional lanes is based on the present and projected traffic volumes for the crossroad. The particular commitment required of the government having jurisdiction over the crossroad depends on the condition of the particular crossroad. If the crossroad is not in existence or is inadequate to carry present volumes, a commitment to improve the crossroad concurrently with the construction of the Interstate is generally required; otherwise, the commitment to improve the crossroad within five years is acceptable.



In a commitment, a "substantial length" of improvement on the crossroad beyond the limits of Federal Aid Interstate fund participation is defined by the distance to the logical termini. The distance to the logical termini is the length of the crossroad to the junction of another highway of similar or greater type and character or to the urban limits. The logical termini is generally the first at-grade intersection on the crossroad adjacent to the Interstate, provided the highway intersecting the crossroad has sufficient capacity to carry the crossroad traffic.

The Federal Highway Administration originally placed maximum limits on the lengths of tapers; however, in most cases the Indiana State Highway Commission did not agree to the short tapers demanded. As design standards changed, the maximum taper lengths have changed accordingly. Nevertheless, there are some short tapers in existence which are inadequate by today's design standards.

Since commitments were needed on many crossroads for additional lanes, the funding for other systems had to be geared to Interstate improvement to honor such commitments. When the cost of overcrossing or undercrossing the Interstate was approximately equal (having also considered possible alternative grades for the Interstate), Indiana generally preferred to overcross the Interstate because there was more flexibility for improving the crossroad.

When a separation was not approved for initial or stage construction, it is not later eligible for Federal Aid Interstate participation. In September of 1964, further explanation of the policy on future separations required that those approved for staged construction had to be completed within the statutory time limit set for the completion of the Interstate System, and allowed the participation of other than Interstate funds in cost of constructing separations that were not approved for initial or stage construction.





Policies on Interchanges. The participation limits for interchange ramps and crossroads are defined by the touch-down points, the proximity of intersecting streets, or the end of taper from the new to existing crossroad as shown in Figure 35 (p. 256). The policies on interchange participation vary little from those for grade separated crossroads without ramps.

Due to the existence of an interchange, Indiana recognized that the access roads to the interchange would eventually have to be upgraded. Over two hundred interchange crossroads have been programmed for improvement, most of these required no commitment at the time the interchange was built.

The commitment to improve a crossroad was based on the individual merits of each crossroad as to the extent it was deficient in capacity for the standards of its system within the twenty-year design period. Because the interchange crossroad had to have adequate capacity to carry traffic to and from the interchange, interchange crossroads were more likely to require improvement commitments than non-interchange crossroads. A commitment was needed primarily when Indiana requested additional lanes through the interchange instead of the existing two-lane facility. If the interchange crossroad was nonexistent or was presently deficient in capacity or alignment, improvement of the crossroad concurrently with the construction of the interchange was required; otherwise, a commitment to improve the crossroad within five years of the construction of the interchange was acceptable.

The commitment required the upgrading of the interchange crossroad to logical termini such as intersecting highways which could handle the interchanging traffic. In the urban area, future traffic assignments were examined to determine the logical termini; intersecting highways, after which the crossroad volume dropped significantly, were generally the logical termini for improvement.





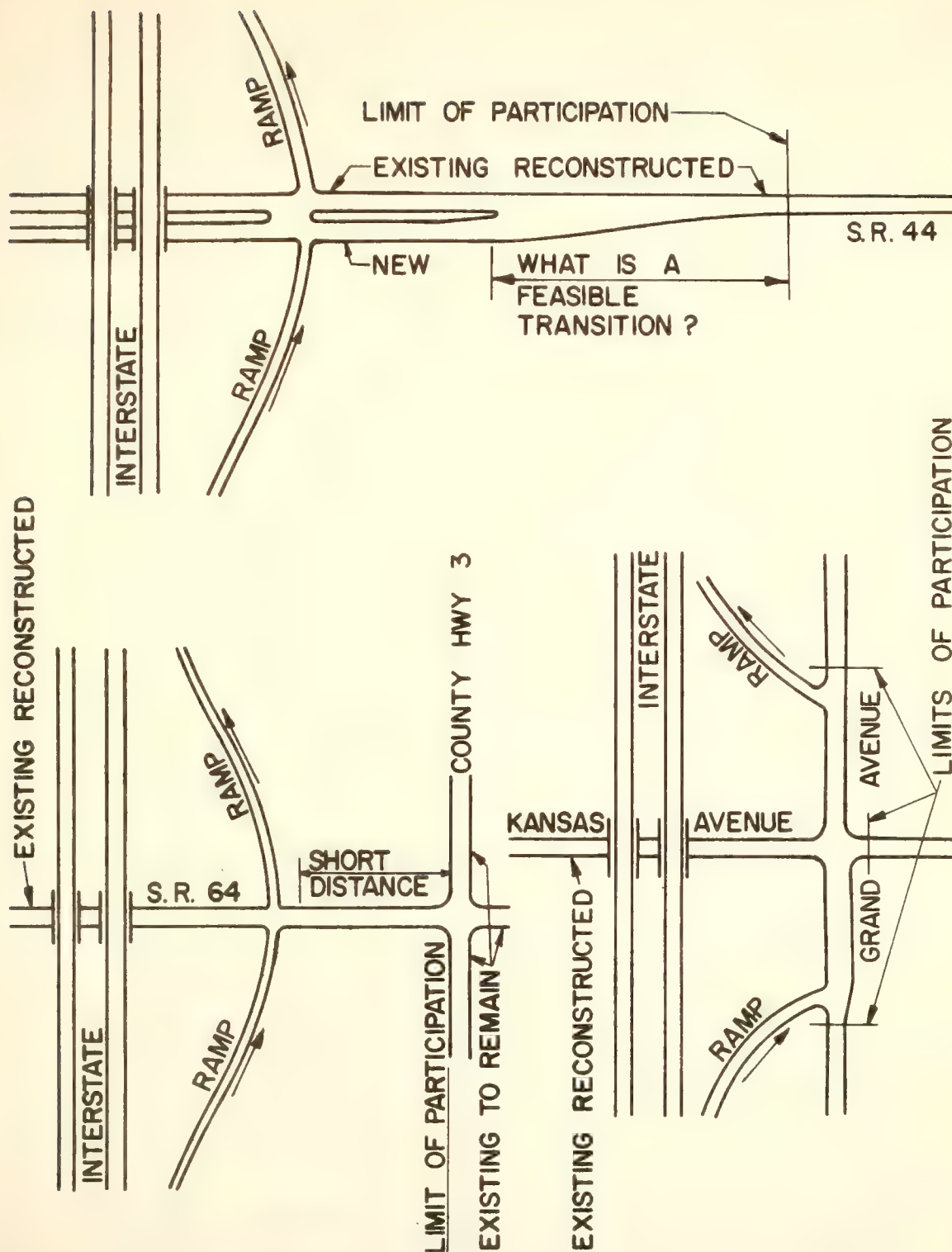


FIGURE 35. LIMIT OF FEDERAL PARTICIPATION FROM INTERCHANGE RAMPS<sup>72</sup>



When Indiana reached the point that it could no longer commit Federal Aid Primary, Secondary or Urban funds to improve Interstate crossroads without jeopardizing the planned improvement of the other systems, the Indiana State Highway Commission requested that four-laning be provided through the interchanges even though the State could not extend the four-laning to a logical termini on the crossroad. In view of the fact that commercial interests would soon develop along the two-lane crossroads and would make future four-laning of the crossroads expensive (if not prohibitive), the Federal Highway Administration considered the accomplishment of a specific procedure prior to approval of the final plans, specifications and estimates for the Interstate project as satisfactory evidence of the intent of the State to upgrade the crossroad to logical termini. The procedure involved the programming of preliminary engineering and right-of-way acquisition for four-lane improvement of the crossroad to logical termini, completing the preliminary engineering to the extent that right-of-way limits could be determined, and acquiring the right-of-way to protect the corridor from future development. Thus, the four lanes through the interchange area that were justified were eligible for full Federal Aid Interstate participation even though the improvement commitment was not present.

The policy for future interchanges is the same as that for future separations. If the interchange is not approved for initial or staged construction, the future interchange can only be built with other than Federal Aid Interstate funds.

Policies on Other Roads. To provide access to property or to maintain the circulation pattern of the local road system, frontage roads are eligible for Federal Aid Interstate fund participation as shown in Figures 36 to 37 (pgs. 258 & 259). In the case of split-diamond interchanges, the





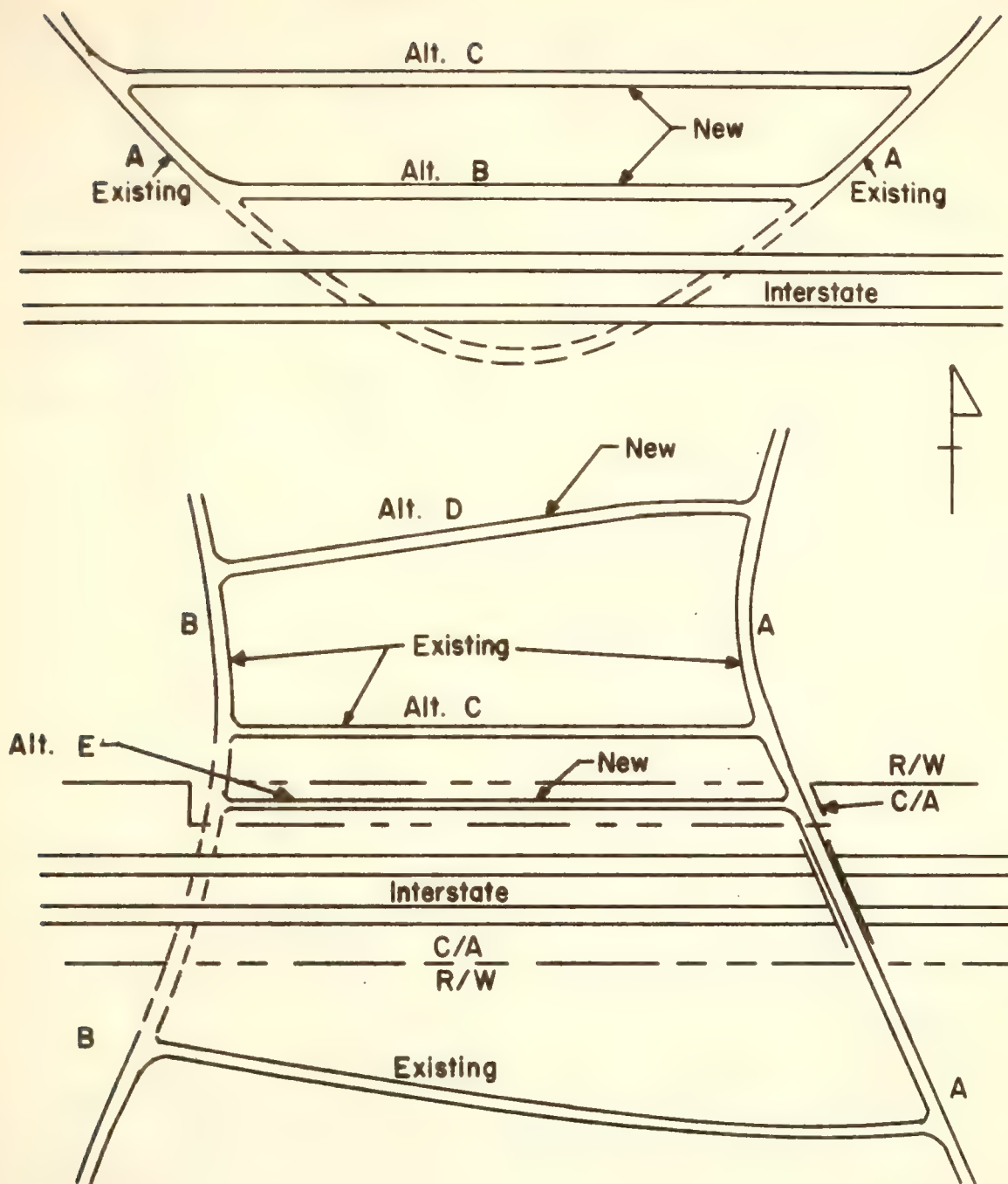


FIGURE 36 FEDERAL PARTICIPATION IN FRONTAGE  
ROADS<sup>73</sup>



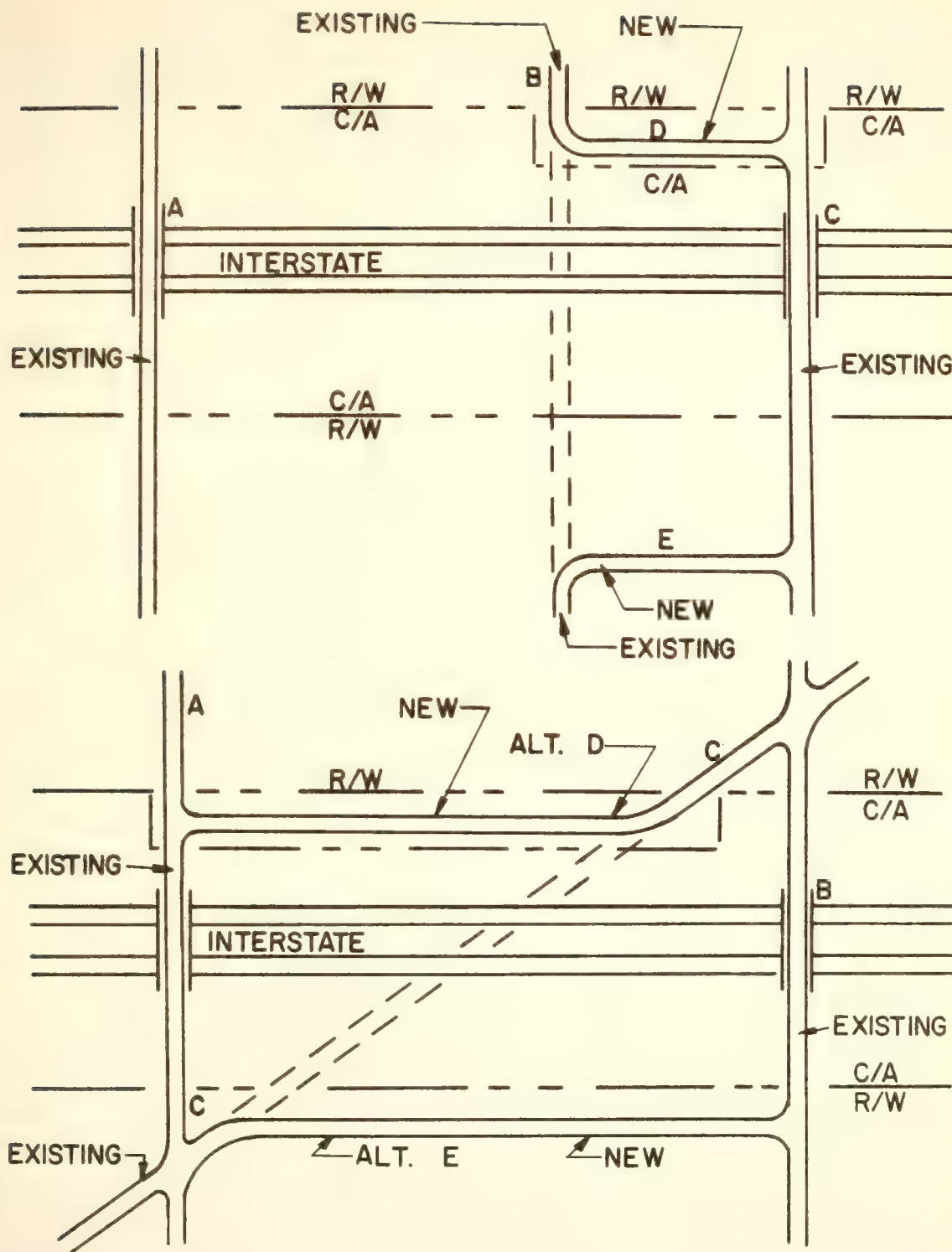


FIGURE 37. FEDERAL PARTICIPATION IN FRONTAGE ROADS<sup>74</sup>



length of the frontage road eligible for Federal Aid Interstate participation is the distance between the ramp and the near side of the first two-way street or the near side of the second street of a one-way pair. Frontage roads not approved as a part of the final plans, specifications and estimates are not eligible for Federal Aid Interstate funding.

A completed segment of the Interstate highway should preferably terminate at an interchange or at a temporary intersection of a crossroad. When this is not practical, temporary connections to other highways are eligible for Federal Aid Interstate participation. Where a crossroad in a rural area is not adequate for the volumes to be accommodated during the temporary terminus of the Interstate, the cost of minimum improvement to the crossroad is eligible for Federal Aid Interstate participation.

Policies on Additional Through Lanes. The design lane capacities for the Interstate System are based on the AASHO publication Policy on Design of Rural Highways. In general, design lane capacities vary with the percentage of trucks in the traffic stream, the type of terrain (level or rolling), and the type area (urban, suburban or rural) which affects the peak hour factor. The characteristics of the area were those for the design year of the Interstate project.

In the past, when the required number of lanes exceeded a full number of lanes ( $N$ ) but the fractional part was less than 0.5, the next highest full number of lanes ( $N+1$ ) was used. With the economy drive in 1960, the policy was to use the lesser number of whole lanes when the required number of lanes exceeded a whole number and the fractional portion was less than 0.5. However, the larger whole number of lanes would be allowed if the State established the existence of special conditions and the Division and Regional Engineers of the Federal Highway Administration concurred. If the number of lanes exceeded four in a rural area, the request





had to be sent to the Washington Office of the Federal Highway Administration after 1968.

Federal guidelines established an optimum number of lanes based on the size of the urban area. For cities exceeding one million in population the number of lanes was not to exceed eight; for cities in a population range of 400,000 to one million the number of lanes was not to exceed six; and for cities under 400,000 in population the number of lanes was not to exceed four. The population of a city was based on the 1960 Census. The number of lanes could exceed the optimum if necessary for efficient operation; however, the Washington Office of the Federal Highway Administration reserved the right to approve a greater number of lanes than the optimum.

The justification for additional lanes was based on traffic assignments, volumes, lane capacities and comments which include the following:

"(a) That alternative forms of transportation as outlined in local transportation studies, would not provide a more effective or more efficient solution.

(b) That other present or proposed highway facilities do not adequately serve the needs for which the Interstate lanes are proposed.

(c) That it is not feasible to provide other traffic engineering and traffic control measures as a solution to the highway transportation problem within the physical limitations of the existing and generally parallel highways.

(d) That all other major and generally parallel highways, present and contemplated, will be operated at their design capacity in the design year.

(e) That the cost of improving other highways within the corridor would be less economical than adding extra lanes to the Interstate System.

(f) That the number of lanes proposed on the section is in keeping with the number of lanes on adjacent completed Interstate sections.

(g) That the section is the common location of two Interstate highways for a portion of their lengths and is designed for the joint traffic thereon."75



Indiana closely followed these guidelines in justifying additional lanes.

In general, additional lanes could only be added to completed sections of the Interstate System if they were initially approved as staged construction at the time of design approval. However, with the change in the design year of the System on October 24, 1963 from 1975 to twenty years hence, many Interstate sections had inadequate capacity for the design year. As was the case with inadequate pavement structure for the design year, additional lanes could be added to those sections on which the design was approved prior to October 24, 1963 to bring the section up to adequate capacity for the design year whether or not the initial construction was identified as initial or ultimate construction. With this revision in policy on January 11, 1967, Indiana was finally able to obtain approval for the third lane on the Tri-State Highway which had been requested for many years but had not been eligible for Federal Aid Interstate participation prior to this time. The additional lanes for Interstate 465 were included in the originally approved construction as stage construction features. As a geometric policy, Indiana requested six lanes on all sections of Interstate when the design year traffic reached 30,000 vehicles per day.

Policies on Safety Improvements. Indiana had pressed for safety improvements on the Interstate System and other systems for many years. However, Federal participation limited the amount of safety improvements as well as highway standards of safety in design. With the Highway Safety Act of 1966, the States were required to have a highway safety program. In August of 1966, the correction of features deficient with respect to current safety standards was eligible for Federal Aid fund participation. The publication of new safety standards in 1967, specifically the Yellow Book





(Highway Design and Operational Practices Related to Safety) by the AASHO, reinforced the highway safety program.

"For safety work to be properly classed as a Federal-aid Highway Safety Improvement Project, the location and/or element proposed for correction must satisfy the following requirements:

- (1) Identified as needing improvement based on accident analysis, and
- (2) Expected to produce a measurable reduction in number and/or severity of accidents."<sup>76</sup>

Safety projects were not necessarily intended to increase capacity or to improve the level of service to traffic. Since the Interstate System was only in existence for a short time, safety projects did not have to be based on accident analysis. Safety projects were intended to eliminate hazardous locations or to upgrade the safety of the roadside environment. The following types of improvements were eligible for Federal Aid participation:

- "(a) Reconstruction of intersections, including channelization, control devices, turning bays and lengthening turning radii;
- (b) Scattered short sections of reconstruction to improve substandard alignment; either vertical or horizontal,
- (c) Removal, relocation and/or redesign of fixed obstacles to provide a clear recovery area for vehicles out of control including gore areas;
- (d) Installation of special signs and markings for unusual hazardous conditions;
- (e) Superelevating and crowning of pavements; resurfacing to provide a higher coefficient of skid resistance on travel lanes, especially during wet pavement conditions;
- (f) Flattening of slopes to provide recovery area for vehicles that have left the traveled way;
- (g) Installation and modification of median barriers, guardrails and delineators; and
- (h) Installation of breakaway features on existing sign and light supports."<sup>77</sup>



Major corrections, such as the widening of bridges to shoulder width or the relocating of bridge piers outside the thirty-foot recovery area, were not eligible under the Federal Highway Safety Program. For the Interstate System, major reconstruction of such features as widening of bridges, revamping of interchanges, revising horizontal or vertical alignment or flattening of slopes was not eligible for Federal Aid Interstate participation. However, if it can be established that a major feature is a definite hazard based on accident experience and that "the expenditure of funds to correct the hazard is supported on a cost-effectiveness basis in comparison with other needed safety work in the State", Federal Aid Interstate funds may participate in major corrective work involving such items as bridge widening, extensive regrading or redesigning of existing basic geometrics.<sup>78</sup>

The State highway safety program was to be based on an analysis of accident occurrence and causal factors. To accomplish this objective the States were to maintain the following on a continual basis: a field reference system to identify accident locations; traffic records to correlate collision data with vehicle, driver and highway data such as geometric features and operational characteristics; a procedure to identify hazardous elements or locations based on an analysis of actual accident experience at specific locations, an analysis of accidents related to geometric features, and the application of accident forecasting methods founded on traffic characteristics; a system to rank safety projects on the basis of their potential for reducing the number and/or severity of accidents; a regular review of the priority list; and a before and after accident evaluation program.<sup>79</sup> The ranking of safety projects was based on cost-effectiveness economic analysis.





In regard to the allocation of Interstate funds available, Indiana has followed a policy of using a substantial amount of the apportionment to complete the Interstate System rather than to upgrade completed sections of the Interstate which have deficient safety features according to current safety standards. The Indiana State Highway Commission followed this policy because greater user benefits and safety benefits would accrue by replacing obsolete primary highways with new Interstate routes than by revising Interstate sections which have already replaced older primary highways. The fact that major reconstruction was not eligible for Federal Aid Interstate funding, except under unusual circumstances, further reinforced the Indiana policy.

Nevertheless, Indiana by 1972 had spent over \$1 million to correct safety deficiencies in guardrails, bridge rails, slopes and gore areas on Interstate 74. Projects had also been let to upgrade signing on Interstate 65 and 69. Consistent with the general policy on the expenditure of funds, Indiana has excluded from current safety improvements major reconstruction such as the widening of existing bridges to shoulder width or the relocating of bridge piers outside the thirty-foot recovery area. Only on the Tri-State highway were the structures widened to shoulder width on the outside. This was done concurrently with the addition of a lane each direction on the inside in 1968. The structures have yet to be widened to shoulder width on the inside. The only major reconstruction eligible for Federal Aid Interstate funding because of accident experience has been the replacement of a loop ramp by a directional ramp at the interchange of Interstate 465 and 70, east of Indianapolis.

In 1967, Indiana estimated that \$18.877 million (\$58,000 for Interstate 64, \$6,260,000 for Interstate 65, \$1,851,000 for Interstate 69, \$2,167,000 for Interstate 70, \$7,430,000 for Interstate 74, \$180,000 for the Tri-State





Highway, and \$931,000 for Interstate 465) would eventually have to be spent to eliminate safety deficiencies on the completed Interstate System. The type of work included in the cost estimate consisted of the following: replacement or relocation of signs; replacement of the approach end of guardrails with buried ends; connection of guardrails to bridge piers or handrails; extension of minor structures to thirty feet from the edge of pavement; and the widening of structures to shoulder width. The cost of widening existing Interstate bridges to shoulder width amounted to \$12.363 million or sixty-five percent of the total cost of the safety program. The figure excluded the cost of widening bridges on other systems overpassing the Interstate System which were originally built with Federal Aid Interstate funds.

Policy on Abandonment and Revision of Plans. If the Federal Highway Administration had approved the location and design up to the point of abandonment of the plans due to unforeseen complications, the Federal Highway Administration would participate in the cost of the old and new plans. Technically, the cost of the abandonment of the old plans was charged against the preliminary engineering cost for the new plans. This situation occurred when Interstate 69 was relocated from a junction with Interstate 70 to a junction with Interstate 465. The design plans were partially completed when the connection to Interstate 70 was abandoned in favor of a connection to Interstate 465.

When Michigan was unable to build Interstate 69 through a lake near the Michigan-Indiana State Line as planned, Michigan had to reroute Interstate 69 around the lake. This necessitated the relocation of Interstate 69 in Steuben County by Indiana and the abandonment of the original design plans by Indiana.



Due to the inability of Indianapolis to execute their design plans in the area of Interstate 70 and Harding Streets as a result of public opposition to the Harding Street Expressway, the Federal Highway Administration participated with Interstate funds in the redesign of the interchange area and with other funds in the redesign of the Harding Street Expressway.

If the Indiana State Highway Commission failed to advance a project by their own choice without the concurrence of the Federal Highway Administration, the State would have to bear the full cost of the engineering of the abandoned plans. Such a case has not occurred on the Indiana Interstate System.

There were many instances when Interstate plans required revision. Whenever design standards were revised, projects still in the design stage were revised to reflect the new design standards. The new safety standards that were adopted by the AASHO in 1967 led to the revision of plans while under design, completed or under construction. Because of insufficient funds at the time some Interstate designs were completed, design plans were not implemented for two to four years. Due to the lag in implementation, final design plans had become obsolete due to new development or upgraded design standards and had to be revised before construction could begin. On Interstate 94, the design plans were outdated because of rapid development in the region and consequently required extensive revision.

When originally approved locations were abandoned before or after the design plans were completed, the comparison of the originally approved alternative with the new alternative included the cost of abandonment of the old plans and the cost to the highway user due to the delay in construction as well as the usual highway, user, and community costs.





Federal Aid Financing on Completed Sections of the Interstate System. Since Congress had intended the Interstate System to be completed simultaneously through apportionments based on successive estimates of the cost to complete the System, the Interstate System was a fixed time span program. Consequently, highway sections which were initially built or substantially completed<sup>80</sup> with Federal Aid Interstate funds were not eligible for further improvement with funds from that source. The only exceptions to this policy were selective safety improvements, certain pavement overlays and final stages of previously authorized stage construction.

The Interstate System is a part of the Federal Aid Primary System. Although work to reconstruct, upgrade or expand a section of the Interstate System is not eligible for further Interstate funding when the section was previously completed according to approved plans, specifications and estimates, the work may be financed with Federal Aid Primary funds.

"Such work may include expansion of, or additions to, the existing highway as well as the reconstruction (not maintenance) of items of previous construction that have not proven satisfactory in performance."<sup>80</sup>

In the early stages of the Interstate Program, sections of existing freeway were incorporated into the System if they met the then current Interstate standards and were adequate for 1975. Although these were considered completed sections of the Interstate System, it was evident by 1971 "that some of these sections are or soon will be seriously inadequate links in the System."<sup>81</sup> If Federal Aid Interstate funds were not used for basic construction or subsequent major improvement, Federal Aid Interstate funds might be used for modest upgrading so that the sections can accommodate 1975 traffic as presently estimated.



Flexibility in Design. Staged construction and advanced right-of-way acquisition provided flexibility in the design of the Interstate System. There was no restriction on the elements that could be considered staged construction provided they were specified in the initially approved plans, specifications and estimates. For projects approved prior to the change in design year, an additional stage of pavement was eligible for Federal Aid Interstate participation if the pavement was deficient for the traffic of twenty years from the date of original construction approval whether or not the original construction was termed initial or ultimate. Since August of 1966, the correction of safety deficiencies has also been retroactive except for major corrections such as the widening of bridges to shoulder width. Shoulders were always considered staged construction because they were initially designed when the design standards lacked many of the now recognized considerations.

Early in the Interstate Program, there were numerous interchanges where Indiana initially constructed only a portion of the interchange and purchased right-of-way for additional through lanes and ramps as future staged construction. Such cases included interchanges on the West Leg of Interstate 465 at Interstate 65 for the extension of the West Leg of Interstate 465 northward; on Interstate 465 at Interstate 69 and at Interstate 70 for directional ramps; on Interstate 465 at Mann Road and West 56th Street to complete half diamonds (which will probably never be completed because of the proximity to other interchanges), on Interstate 65 near West 38th Street for the Harding Street Expressway; on Interstate 65 near Memphis to complete the half-diamond at Blue Lick Road; and at other locations.

In a few "hardship" cases, Indiana was given the authority to purchase right-of-way for a future interchange (at SR 341 near Hillsboro on Interstate 74) and for future





separations provided they were included in the initially approved design plans and were completed prior to the end of the Interstate Program. However, the advanced land acquisition for future interchanges as a part of staged construction was only permitted before the interchange spacing guidelines were established in 1960 and for only a short time thereafter. Since 1960, Indiana has had no future interchanges programmed as staged construction in the initially approved construction plans. However, if LaPorte County makes a commitment to upgrade Wagner Road (County Road 1000N), interchange ramps to Interstate 94 would be provided. Indiana has programmed a few separations as staged construction. Separation structures will be built at Taft Street and Samuelson Road on Interstate 94 provided the local governments upgrade the crossroads. If Indiana fails to complete stage construction before the end of the Interstate Program, Indiana will have to bear the full cost of any unused designs and right-of-way.

Additional lanes have been added to Interstate 465 and the Tri-State Highway as a part of staged construction. Because the Tri-State Highway and the Lebanon Bypass were incorporated into the Interstate System, they were eligible for pavement overlays as staged construction. The flexible pavement on Interstate 64 is also a part of staged construction.

### The Role of Traffic Engineering in Interstate Design

In the earlier stages of the Interstate Program, the Indiana State Highway Commission Division of Traffic Engineering was consulted on Interstate design; however, as techniques became more routine and the experience of the designers and the Federal agency grew, the Division of Traffic Engineering was consulted to a lesser degree. The





traffic engineering input into Interstate design was in the area of accident experience and the relationship of accidents to geometric features.

The evolution in traffic control devices and safety features on the Interstate System was generally due to increased speed and the availability of wider right-of-way. The higher speeds on the Interstate System required larger signs with larger letters and the location of signs farther in advance of the decision point. The increased right-of-way width of the Interstate System over other systems has offered greater flexibility in the lateral placement of signs.

Indiana had adopted many safety features prior to their publication in the Highway Safety Act of 1966 and the Yellow Book of 1967. In fact, some uses of safety-oriented features recommended by the Indiana State Highway Commission prior to August of 1966 were not approved by the Federal Highway Administration due to the increased cost or ineligibility for Federal Aid Interstate fund participation. Indiana has very rarely designed to the minimum standards for safety and has most often designed to the maximum standards eligible for Federal participation.

The Division of Traffic Engineering provides the accident information to support the Indiana Highway Safety Program. Because the Interstate System has been in existence only a short time, sufficient accident information does not exist to correlate accidents with design features. Furthermore, the capability of correlating accidents with design features is not very advanced. Consequently, the priorities in correcting design features which have safety deficiencies are based on a cost-effectiveness comparison of high accident areas on the Interstate System.

In the design of interchanges, the traffic engineers generally review the final design for signing and lighting needs. When interchanges were designed with signalization



on the ramps at the crossroad, the Indiana State Highway Commission waited until the traffic pattern had stabilized before installing signals. This policy insured the installation of signals only after they were warranted. The traffic engineers work with the interchange planners and designers to determine the line of access control and to aid in the design of access on the interchange crossroads.

### Other Function Areas

This subchapter covers the evolution, philosophy and practice of new concepts in highway design and implementation such as joint development of the highway with other capital improvements, the multiple use of the highway right-of-way, and the environmental emphasis; utility relocation; roadside development which includes landscaping and billboard and junkyard control; land acquisition; the relocation of households and businesses; construction; and maintenance.

### New Concepts

In planning and designing the Interstate System, one of the major objectives was to insure that highway improvement was consistent with the planning programs and goals of the community. This implied that the agencies making the highway improvement should cooperate with other agencies concerned with land use plans and development plans to achieve the overall objective of raising the standards of living and enhancing community values. "Making the best use of scarce land both in high-density metropolitan areas and in rural areas (was) recognized to be one of the most important means of raising standards and enhancing values."<sup>82</sup> The concepts of joint development and multiple use were a means of attaining such objectives. The environmental impact statement served as a mechanism to insure the compatibility of highway improvement with the environment.





Joint Development. When the character of an existing highway is changed or a new highway is developed through an existing urban structure, the existing land may no longer be compatible with the character of the adjacent highway. The residential development which paralleled the at-grade arterial may no longer be the most appropriate land use for the new freeway because of increased land values (which reflect increased accessibility) and freeway nuisances. If the existing land uses affected by the freeway are not changed through rezoning or systematic redevelopment as the freeway is built, natural redevelopment over time may result in a patchwork redevelopment. The introduction of new uses scattered among the old may result in the incompatibility of uses within the area surrounding the highway improvement as well as incompatibility with the highway improvement. Joint development of the highway improvement and the surrounding area is a means to insure development along the highway improvement which is compatible with the highway and the surrounding area.

Joint development has always been permitted, and has been strongly encouraged by the Federal Highway Administration since the passage of the Intergovernmental Cooperation Act of 1968. Joint development was considered an important part of the overall strategy of development and renewal of urban areas. Although the primary benefits of joint development were the assurance that the highway was compatible with surrounding land use and the assurance that development was consistent with the planning objectives of the community, joint development had several other benefits such as "(1) the channeling to the community of the increases in land values generated by the highway, rather than "windfall" profits to some individual land owners or speculators at the expense of other owners and the community; (2) the reduction in inequitable gains or losses in land values influenced by



the highway improvement; (3) elimination of "remainder" parcel problems; (4) more ready acceptance of the improvement by nearby citizens; and (5) from the point of view of the highway official, the assurance of retaining demands within the designated capacity, and the opportunity to reserve space for added capacity increases where future demands cannot be reasonably forecast."<sup>83</sup>

The major drawback to joint development was implementation. There were problems in coordinating the variety of local, State and Federal agencies involved, in administering the project, in determining the project area, and in acquiring the land adjacent to the highway. Because the collection of data on the social, economic and environmental impact of route location alternatives was an integral part of the highway location study, the data collection for the joint development study (termed "joint development reconnaissance") was eligible for Federal aid reimbursement as a part of preliminary engineering. After the route was selected and approved, the local jurisdiction assumed the responsibility of completing the plan.

Since the Indiana State Highway Commission can only condemn land for highway uses, urban renewal is the only means to acquire land adjacent to new highway improvements. Few States have passed legislation to allow a State agency in the real estate business. Indiana attempted to coordinate a highway improvement with an urban renewal project in the Calumet Area. The urban renewal project was to acquire all the right-of-way and furnish part of the right-of-way for the highway; however, because the approval for the renewal project and highway project came from two different Federal agencies (the Department of Housing and Urban Development and the Department of Transportation), it was difficult to coordinate the two projects. In the Jeffersonville area, an urban renewal project in the waterfront area was able to





provide the land for an additional ramp to Interstate 65; however, the urban renewal project came after the Interstate.

Joint development was considered cumbersome in Indiana because of the inability to get the necessary elements coordinated simultaneously. Joint development timing is further complicated by the fact that an area may not be appropriate for an urban renewal project even though a highway improvement is being planned.

The emphasis on joint development came after the final route locations were approved for all the Indiana Interstate routes except Interstate 164 and 275, which are located in rural areas. The only joint development project underway in Indiana is for the Northeast Freeway in Indianapolis. In the future, the Indiana State Highway Commission and Federal Highway Administration believe joint development will become a necessity to sell urban freeways to the public.

Multiple Use Development. Multiple use development is the utilization of public right-of-way for more than one purpose. Multiple use development requires the close cooperation of the State highway department and the local governmental agencies. Proposals for multiple use must be in conformance with the comprehensive land use plan of the community and require documentation as to the extent environmental factors have been considered. Multiple use development provides a means to utilize scarce urban land to the fullest extent possible. Air rights above and below the facility and right-of-way not utilized for the facility would become maintenance liabilities to the community and highway department without development to make the land beneficial to the community.

Multiple use development is more easily implemented than joint development because the land for multiple use development





can be purchased under existing legislation by the State highway department. The State highway department purchases the land for the primary use of public highways and leases or conveys the portion for other uses to the local government or another party. Multiple use development and highway development need not occur simultaneously and the highway improvement is not contingent on the approval of multiple use development, unlike joint development.

The feasibility studies undertaken to evaluate and develop recommendations on multiple use of highway right-of-way are eligible for Federal Aid Interstate funding as preliminary engineering. Acquisition of whole parcels or portions of the remainders to a logical barrier or boundary, such as a street, is eligible for Federal Aid Interstate funding; and the areas not required for safety, maintenance and operation of the highway may be devoted to other uses. Based on the premise that "work needed to make the highway conform to its environment in a reasonable manner is a part of the basic highway cost", Federal Aid Interstate funds may participate in the following: construction of mini-parks; site preparation for recreational facilities; lighting, fencing, curbing, landscaping, false ceilings and a minimum type of hard surfacing on areas under a viaduct for safety and aesthetics; modification of structures to encourage multiple use development; and the utilization of structure instead of embankment to promote development beneath the structure, to improve local traffic circulation, or to provide better public services.<sup>84</sup>

At the beginning of the Interstate Program, air rights would only be used for highway related purposes. The Federal Aid Highway Act of 1961 allowed any use of the air rights, except service stations or other commercial establishments serving the highway user, provided it did not impair the full use and safety of the highway and was not



given access to the freeway. This policy applies to all multiple uses of the Interstate right-of-way. Any multiple use of Interstate right-of-way requires the execution of an agreement with provisions protecting the integrity of the freeway. When land is conveyed for multiple use, restrictive covenants describe or limit the development and make the development plans subject to the approval of the State highway department and local government.

The Indiana State Highway Commission prefers to lease highway right-of-way for multiple use development. The City of New Albany executed an agreement with the Indiana State Highway Commission to utilize the ponding area along Interstate 64, required for flood control of the Ohio River, for recreational purposes. Agreements have been made with the Department of Metropolitan Parks in Indianapolis for the utilization of up to fifteen parcels for mini-parks and recreational areas. The Indianapolis Department of Development and Department of Transportation in cooperation with the Indiana State Highway Commission are preparing plans for a parking area under the North Leg of the Indianapolis Inner Belt.

In Indiana, the multiple use concept has little other applications except for utilities and uses such as recreation and parking facilities because of the low intensity of development in urban areas. Only when the cost of developing on air rights is comparable to the cost of developing on other land, will major land uses utilize highway air rights.

Environmental Emphasis. The Indiana State Highway Commission has always been conscious of the impact of highway improvements on the environment. In the location of route alternatives for the Interstate System, it was a general policy to avoid rich farm land, wooded areas, parks, cemeteries, recreation areas, schools, churches, other public and quasi-public institutions, residential areas, and other





development. The effect of the highway improvement on existing development was an integral part of the Interstate route location studies and was a consideration in evaluating route alternatives. For the Interstate route location studies in the Indianapolis Metropolitan Area, special studies were made of the number of people and businesses to be dislocated, the number of residences and businesses to be acquired, and the right-of-way cost for the various alternatives. These considerations were of primary importance in evaluating route alternatives. The environmental emphasis in the latter part of the Interstate Program broadened the span of environmental considerations in highway development and most of all required documentation that these environmental considerations were an integral part of the highway location and design alternative evaluation process.

Since the Interstate Program began, archeological and paleontological salvage was eligible for Federal Aid Interstate funding. The reconnaissance survey, preliminary site examination and salvage work were all eligible for Federal funding. In connection with the Indiana Interstate Program, the only major archeological salvage project has been on Interstate 275 in the Ohio River bottomlands.

In 1963, a formal agreement with the State fish and game departments was required to establish the review by conservation agencies of proposed highway improvements for possible effects on fish and game resources. As of January 1, 1964, the submission of plans, specifications and estimates for the approval of all Federal aid projects was to be accompanied by a statement that the State highway department had considered the recommendations of the State fish and wildlife agency and the effect of the highway improvement on these resources. The statement had to specifically include "(1) a description of the measures planned as project expenditures to minimize the effect of



the proposed construction on fish and wildlife resources; (2) a description of any measures proposed by the State fish and wildlife agency to accomplish this purpose, which differ from those proposed by the State highway department; and (3) to the extent that measures proposed by the State highway department and State fish and game agency differ, an explanation of the factors considered by the State highway department in arriving at its proposal."<sup>85</sup> This procedure has since become a part of the A-95 Review Process. Since the Indiana State Highway Commission had worked with the Indiana State Department of Natural Resources many years prior to this requirement, the agreement was a formality to show the Bureau of Public Roads that such cooperation existed.

In September of 1964, the documentation of location decisions was to include evidence that water conservation (water pollution) was considered. Water conservation was expanded to include erosion, sedimentation and other water pollution problems in June of 1966. As of January 1, 1967, the plans, specifications and estimates for all Federal Aid highway projects were to contain provisions to keep water pollution caused by highway construction to a minimum. This requirement brought about a general revision in State highway department construction specifications on the scheduling and conducting of construction operations to prevent water pollution. Revisions of the specifications were to include the following provisions: limitations on the area of land exposed by construction operations at any one time; limitations on the duration of exposure of uncompleted construction elements; concurrent construction of erosion control features; limitations on the location, operation and fixed conditions of temporary borrow pits; and compliance of all sanitation facilities with local health regulations or State health standards. The Indiana State Highway





Commission revised their construction specifications accordingly. (Further discussion on specifications is under "Construction Evolution" in this subsection.).

The Federal Aid Highway Act of 1968 required the consideration of the social and environmental effects of highway location at public hearings; the economic effects of highway location had been considered at public hearings since 1956. Consequently, social and environmental considerations were added to the economic considerations in the route location, alternative evaluation and decision-making processes. Section 138 of the Federal Aid Highway Act of 1968 and section 4(f) of the Department of Transportation Act of 1966 declared the preservation of parklands a national policy.

Since August 23 of 1968, the Secretary of Transportation would not approve any federally funded project that required "the use of any publicly owned land from a public park, recreation area, or wildlife and waterfowl refuge of national, State, or local significance as determined by the Federal, State, or local officials having jurisdiction thereof, or any land from an historic site of national, State, or local significance as so determined by such officials unless (1) there (was) no feasible and prudent alternative to the use of such land, and (2) such program (included) all possible planning to minimize harm to such parks, recreational area, wildlife and waterfowl refuge, or historic site resulting from such use."<sup>86</sup> This requirement culminated in the "4(f) Statement" whenever a highway project affected parkland.

The National Environment Policy Act of 1969, signed January 1, 1970 by the President, established a national policy which encouraged a productive and enjoyable harmony between man and the environment and promoted efforts to prevent, eliminate or minimize damage to the environment. In connection with all direct Federal or federally assisted programs, the Act required that all Federal agencies "utilize





a systematic, interdisciplinary approach which will insure the integrated use of the natural and social sciences and the environmental design arts in planning and in decision-making which may have an impact on man's environment."<sup>87</sup>

. To insure that environmental amenities and values were considered in the decision-making process along with economic and technical considerations, the Federal agencies in cooperation with the Council on Environmental Quality were to develop appropriate methods and procedures. Every proposal for legislation or major Federal actions were to include a detailed statement on "(i) the environmental impact of the proposed action, (ii) any adverse environmental effects which cannot be avoided should the proposal be implemented, (iii) alternatives to the proposed action, (iv) the relationship between local short-term uses of man's environment and the maintenance and enhancement of long term productivity, and (v) any irreversible and irretrievable commitments of resources which would be involved in the proposed action should it be implemented."<sup>88</sup> In the preparation of the environmental impact statement, the agency sponsoring the proposal has to consult and obtain comments on the environmental effects of the proposal from any agency whose jurisdiction will be affected by the project. These statements were to accompany the proposal through the A-95 Review Process.

The scope of environmental concern was further defined by the guidelines mandated by the Federal Aid Highway Act of 1970, signed December 31, 1970. Section 136 of the Act required the Secretary of Transportation (a) to issue, within thirty days, guidelines for minimizing soil erosion from highway construction; (b) to promulgate, prior to July 1, 1972, guidelines "designed to assure that possible adverse economic, social, and environmental effects relating to any proposed project on any Federal-aid system have been fully



considered in developing such project, and that the final decisions on the project are made in the best overall public interest, taking into consideration the need for fast, safe and efficient transportation, public services, and the costs of eliminating or minimizing such adverse effects and the following:

- (1) air, noise, and water pollution;
- (2) destruction and disruption of man-made and natural resources, aesthetic values, community cohesion and the availability of public facilities and services;
- (3) adverse employment effects, and tax and property values losses;
- (4) injurious displacement of people, businesses and farms; and
- (5) disruption of desirable community and regional growth";

(c) to develop standards for highway noise levels compatible with different land uses; (d) to promulgate guidelines on air quality.<sup>89</sup>

The soil erosion guidelines and the air quality guidelines have generally been incorporated into the Indiana construction specifications. Eventually air quality will become a consideration in the evaluation of highway locations and designs (especially in comparison of elevated, at-grade and depressed designs) in urban areas. The noise abatement and economic, social and environmental guidelines have generally been incorporated into the environmental statement process.

In January of 1972, the State highway departments were requested to develop an Action Plan for meeting the requirements of Section 136(b) of the Federal Aid Highway Act of 1970 concerning the economic, social and environmental guidelines. The Action Plan was to outline the assignment of





responsibilities for meeting the guidelines within the State highway department and to other agencies; to describe the existing and new procedures to be followed for the conduct of technical studies on social, economic and environmental effects and for management of the process; and to indicate the steps to be taken to implement the Action Plan. The technical study procedures were to include the identification of environmental effects, the consideration of alternative courses of action, the involvement of other agencies and the public, and the arrangements to assure a systematic interdisciplinary approach. The management of the process concerned the review of the decision-making process to assure the consideration of economic, social, environmental and transportation factors; the interrelation of system and project decisions as they affect the environment; and the level of action by the agencies involved.

The overall intent of the Action Plan was to assure the "early identification and study of economic, social and environmental effects to permit analysis and consideration while alternatives (were) being formulated and evaluated"; to involve other agencies and the public early enough to influence the technical studies and final decisions; and to assure full consideration of all reasonable alternatives including not building the project.<sup>90</sup> The Action Plan was to be coordinated with appropriate local, state and Federal agencies, including the A-95 Review clearinghouse; to be approved by the State Governor; and to be forwarded to the Federal Highway Administration by April 1, 1973.

The Environmental Impact Statement and the 4(f) State-ment Processes. Interim guidelines for the environmental impact statement process were promulgated on November 24, 1970 and the guidelines were distributed on August 24, 1971. The overall intent of the environmental impact statement process was to insure that environmental considerations were



taken into account in the planning, alternative evaluation and decision-making processes. The environmental impact statement process also tended to increase citizen and agency input into the decision-making process.

The environmental statement guidelines were based on section 102(2)C of the National Environmental Policy Act of 1969 which required a statement of the environmental impact of all direct Federal and federally assisted proposals; section 4(f) of the Department of Transportation Act of 1966 which concerned the preservation of parkland; section 470f of Chapter 16 of the United States Code which concerned historic site preservation; and section 309 of the Clean Air Act of 1970 which required the Environmental Protection Agency to review and comment on the environmental impact of federally funded projects.

Most of the Indiana Interstate projects had been located, designed and the right-of-way acquired before the National Environmental Policy Act was signed into law on January 1, 1970. Consequently, an environmental impact statement was not required for highway projects which received design approval before January 1, 1970.

Highway sections that received design approval on or after January 1, 1970 and before February 1, 1971 and constituted a major action significantly affecting the environment were reassessed by the State highway department in consultation with the Federal Highway Administration division engineer to determine if the plans would develop in such a manner as to minimize adverse environmental consequences. No environmental impact statement was required unless the division engineer considered the preparation and processing of a statement necessary to implement the National Environmental Policy Act to the fullest extent.





"In making his judgement the Federal Highway Administration division engineer (was to) consider, in addition to the written reassessment prepared by the Highway Agency for each such highway section, the status of design; right-of-way acquisition including demolition of improvements within the right-of-way; number of families already rehoused and those yet to be rehoused; construction scheduling; benefits to accrue from the proposed highway improvements; significant impacts; and measures to minimize any adverse impacts of the highway."<sup>91</sup>

The State highway departments were to modify projects to the extent practicable to minimize any adverse impacts. Because major action projects constituted projects on new locations or major reconstruction projects which required additional right-of-way for fifty percent or more of its length, all Interstate projects that fell in this time span had to be reevaluated. Few Interstate sections in Indiana required such evaluation and the only notable section was on Interstate 70 from the northeast interchange with Interstate 65 to Ritter Avenue in Indianapolis.

The Indiana Interstate projects, that received location approval prior to the two hearing requirements of January 4, 1969, that lacked the design hearing and subsequent design approval and that had not proceeded substantially into the right-of-way acquisition process, were generally required to have an environmental impact evaluation (reevaluation) by the Indiana Division Engineer of the Federal Highway Administration. The Indiana State Highway Commission reported negative declarations (no significant effect on the environment) for such projects.

Highway proposals that received design approval on or after February 1, 1971 were required to have a full environmental impact statement and a section 4(f) statement if parklands were involved. Indiana has completed an environmental impact statement for all of Interstate 275 and for the interchange of Interstate 70 and the Harding Street





expressway which also required a 4(f) statement as a portion of Rodius Park was involved. An environmental impact statement will have to be completed for Interstate 164 when it is located and may be required for Interstate 65 from the southeast interchange with Interstate 70 to one-half mile north of Keystone Avenue in Indianapolis.

The evaluation of environmental impact begins during the highway location studies. [Refer to Figure 38 , p. 287]. During the evaluation of location alternatives, the State highway department determines whether or not the project will have a significant environmental impact. If the anticipated effects upon the environment will not be significant, the State highway department prepares a "negative declaration". If the anticipated effects upon the environment are significant, a draft environmental statement is prepared. The negative declaration continues through the public hearing and location approval process and is only available for information to the A-95 Review agencies. The negative declaration goes no further than the Federal Highway Administration division engineer who also approves the project location. The draft environmental statement is circulated to the A-95 Review agencies for comment and made available to the public before the hearing.

After the public hearing is conducted, the route location is selected and the final environmental statement is prepared. The final environmental statement, with comments of the review agencies, is submitted to Regional Federal Highway Administrator and then to the Department of Transportation's Office of Environment and Urban Systems for concurrence. The final environmental statement is also made available to the public, Council on Environmental Quality and Environmental Protection Agency for comment. The agencies normally have thirty days plus mailing time to comment on the final environmental statement, except for the Environmental



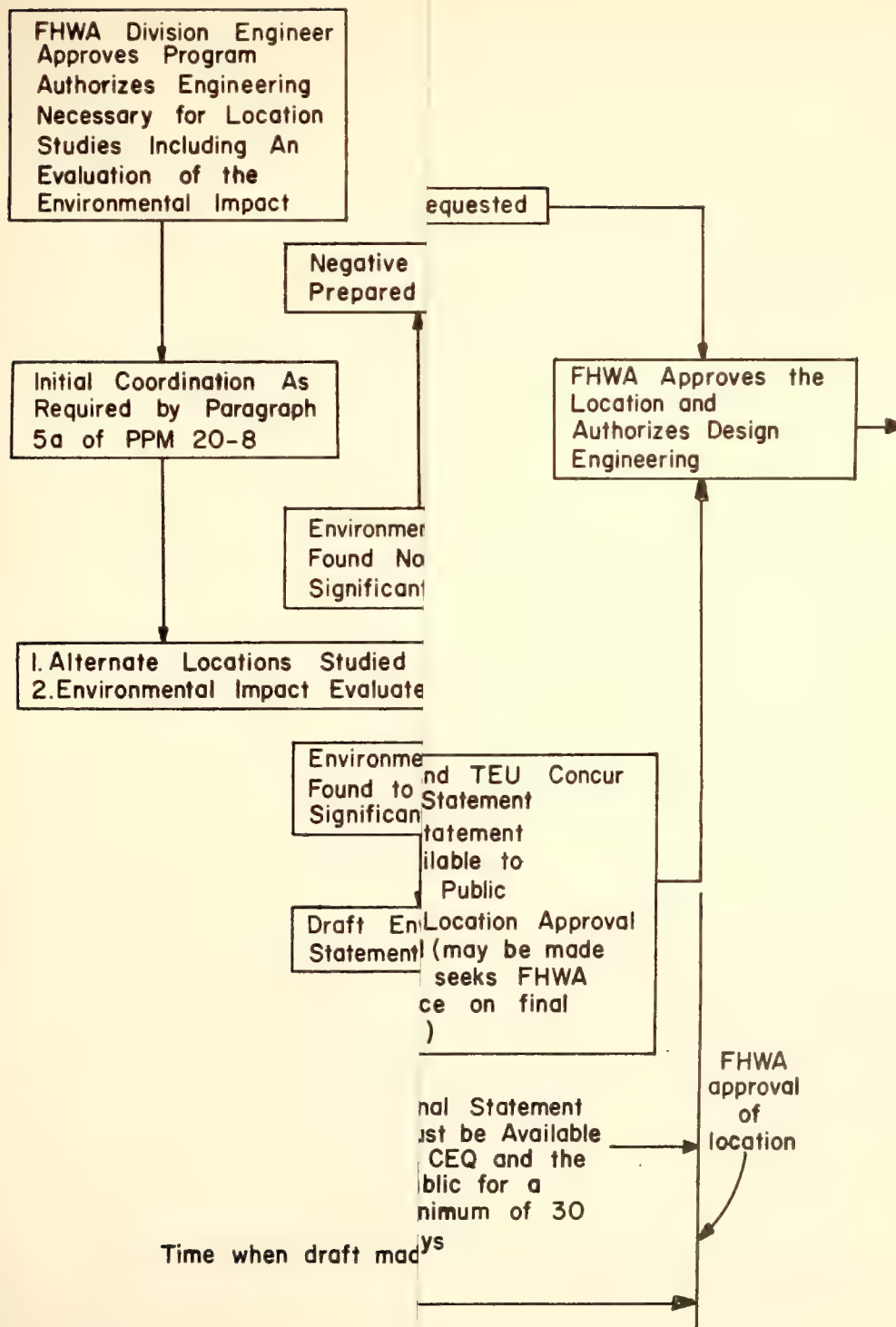
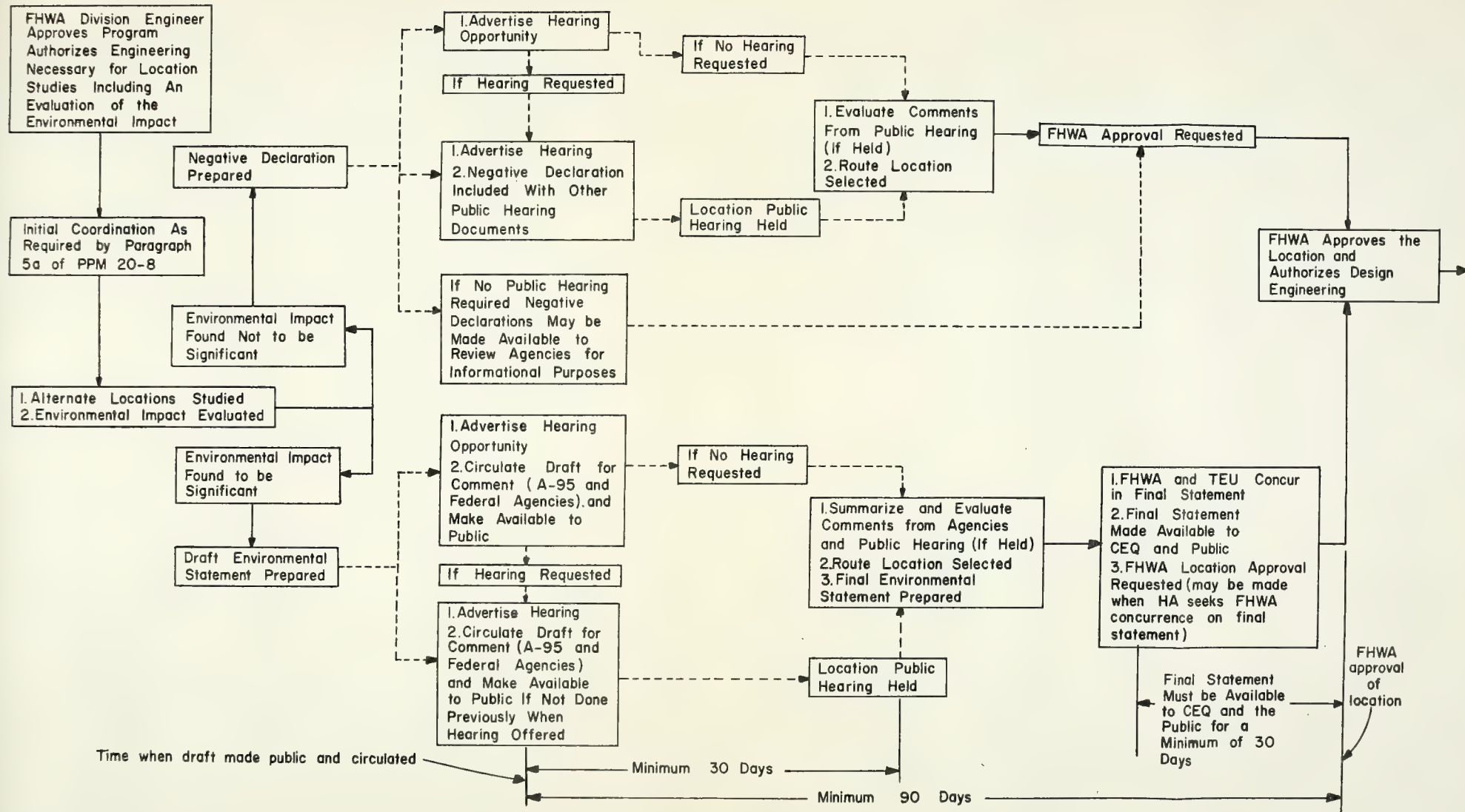


FIGURE 38. ENVIRONMENTAL





FIGURE 38. ENVIRONMENTAL IMPACT STATEMENT PROCESS AT THE LOCATION STAGE <sup>92</sup>



Protection Agency which is allowed forty-five days plus mailing time. Only the Environmental Protection Agency has the power to reject the final environmental statement; the other agencies may only request revisions in the project to minimize adverse environmental effects.

Based on a minimum of sixty days for the A-95 Review agencies to comment on the draft environmental statement and a minimum of thirty days for the appropriate agencies to review the final environmental statement, the environmental statement process requires a minimum of ninety days for the circulation of the draft environmental statement and advertisement of the public hearing to the approval of the route location by the Federal Highway Administration. In practice, the environmental statement is in draft form for three months and final form for one month; however, the process may stretch out to six months. The environmental statement process consequently adds a minimum of one month to the time needed to develop a project.

An environmental statement may also be required at the design stage if new significant impacts are uncovered during the evaluation of design alternatives or if the location was approved prior to the application of the National Environmental Policy Act. [Refer to Figure 39, p. 289 ]. In most cases, the environmental impact statement developed at the location stage needs only minor revisions when it reaches the design stage. The environmental statement process at the design stage is identical to that at the location stage.

Content of Environmental Impact Statement. The content of the environmental impact statement is based on the five major points of section 102(2) of the National Environmental Policy Act (which are listed on page 281). The location, description and purpose of the project appear first in the environmental impact statement.<sup>93</sup> If any parklands are involved, they must be described in the 4(f) statement which accompanies the environmental impact statement.



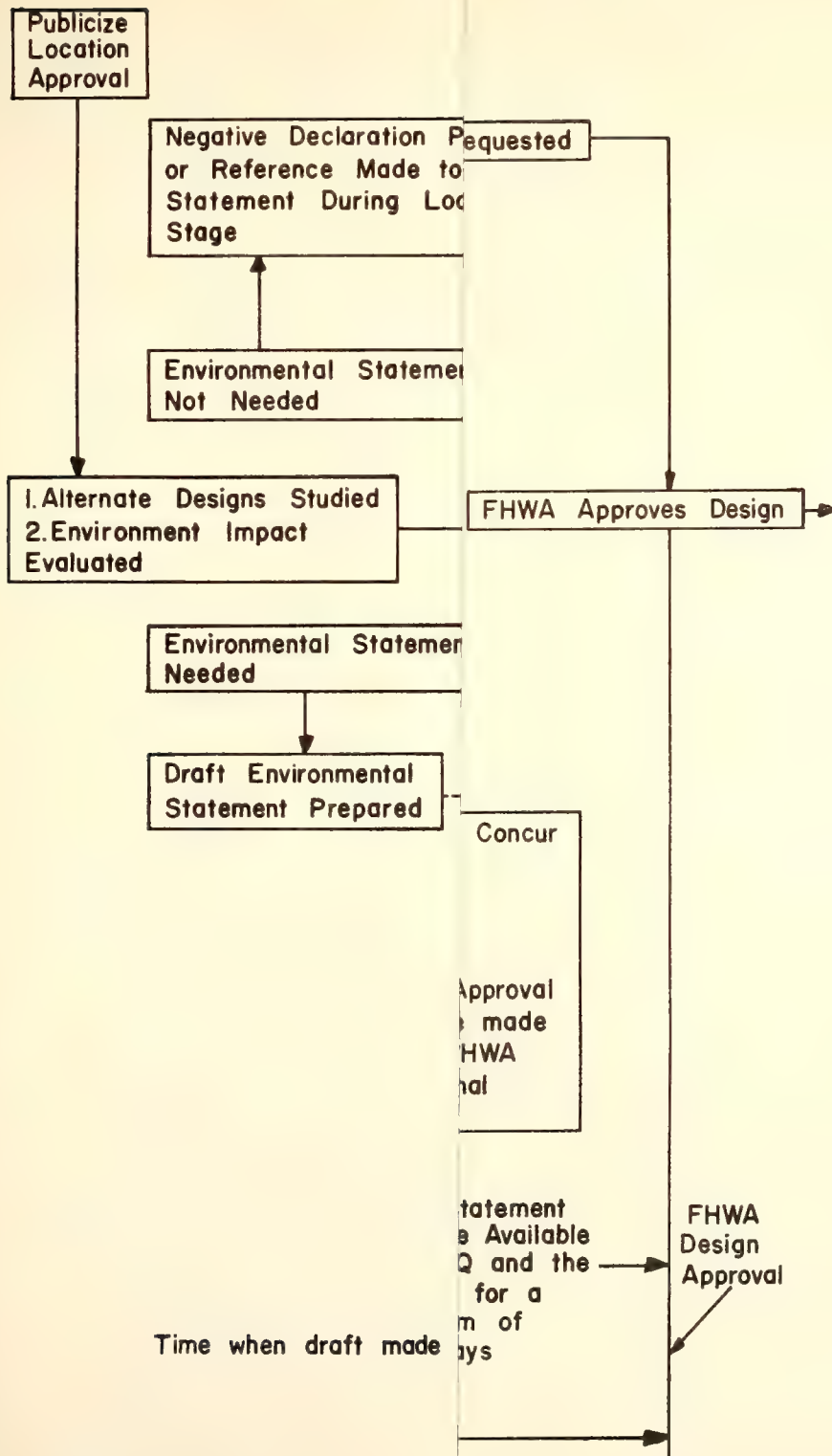


FIGURE 39. ENVIRONM





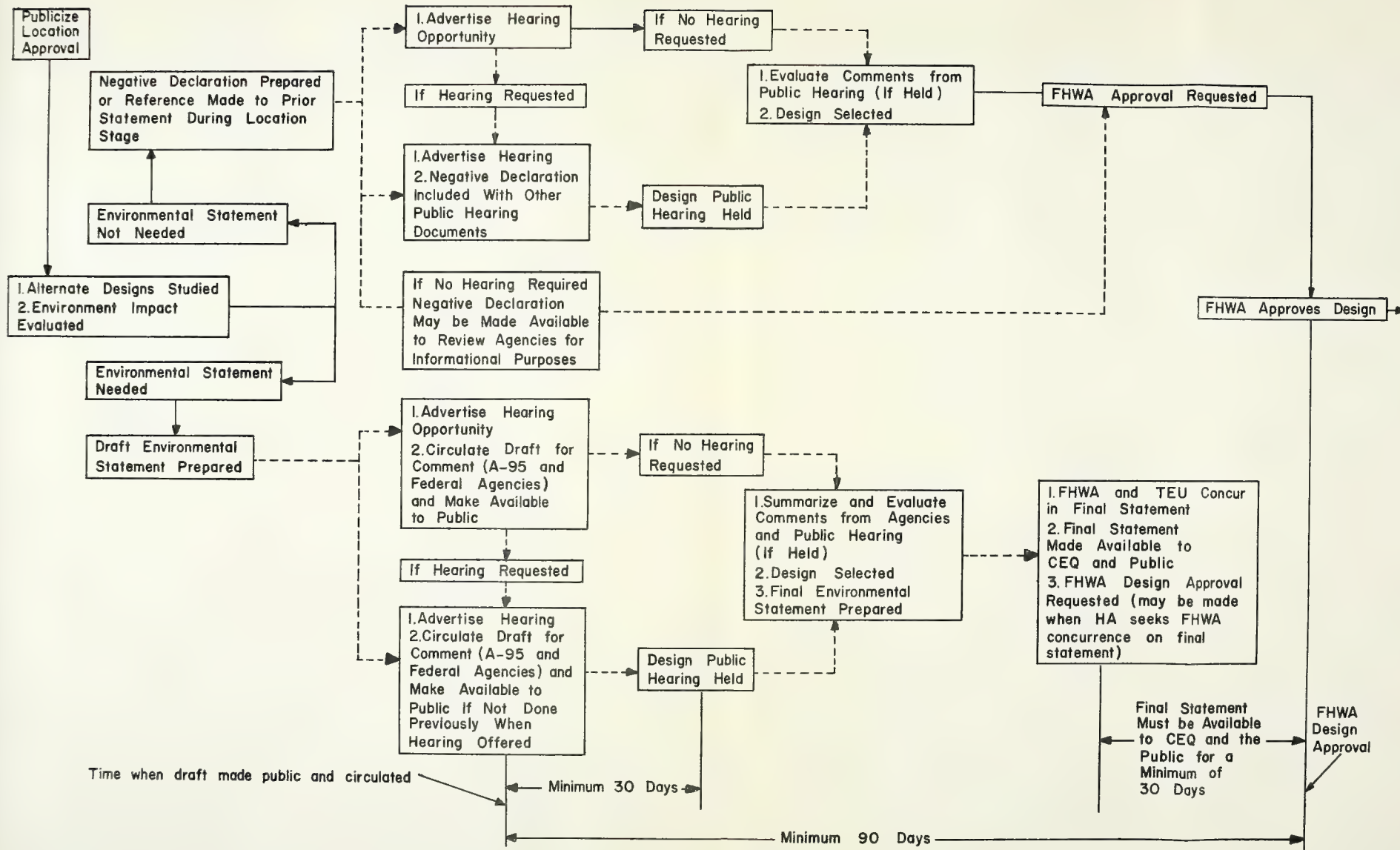


FIGURE 39. ENVIRONMENTAL IMPACT STATEMENT PROCESS AT THE DESIGN STAGE<sup>94</sup>



The probable impact of a project is discussed in the first part of the environmental impact statement. This evaluation includes both the beneficial and detrimental consequences of the project on the State, region or community. A highway improvement is considered to have a significant affect on the environment if it has an "adverse impact on natural, ecological, cultural, or scenic resources of national, State or local significance"; if the location is "highly controversial regarding relocation housing resources"; if the location "divides or disrupts an established community or disrupts orderly planned development or is inconsistent with plans or goals that have been adopted by the community in which the project is located or causes increased congestion"; and if the improvement is inconsistent with national standards on the environment.<sup>95</sup>

In discussing the environmental impacts, emphasis is to be placed on the efforts to minimize the impact rather than on quantifying the impact. According to the Indiana State Highway Commission guidelines on the preparation of environmental impact statements, the following projects are considered to have a significant impact on the environment:

"(a) Any project that is likely to be highly controversial on environmental grounds.

(b) Any project involving land covered by Section 4(f) of the Department of Transportation Act or any other land used for recreational purposes.

(c) Any project leading to a noticeable change in surrounding noise level.

(d) Any project that will displace significant numbers of people.

(e) Any project that will disrupt or divide an established community.

(f) Any project that will have a significant aesthetic or visual effect.

(g) Any project that will have any effect on areas of unique interest or scenic beauty.

(h) Any project that will substantially alter the pattern of behavior for a wildlife species.





(i) Any project that will interfere with important breeding, nesting, or feeding grounds.

(j) Any project that will lead to significantly increased air or water pollution in a given area.

(k) Any project that will adversely affect the water table of an area.

(l) Any project that will significantly disturb the ecological balance of a land or water area.

(m) Any project that will involve a reasonable possibility of contamination of a public water supply source, treatment facility, or distribution system."<sup>96</sup>

These factors are discussed for the general corridor of the project.

Any probable adverse environmental impact which cannot be avoided must next be discussed. All adverse effects, temporary or permanent in nature, must be presented and explained. Adverse effects which can be reduced in severity or to an acceptable level as a result of different location alternatives must be included. The planning measures proposed to minimize unavoidable adverse environmental effects must be identified.

All available alternatives to the proposed project, including the do nothing alternative, must be presented with their beneficial or adverse consequences. The Environmental Protection Agency has placed increased emphasis on the discussion of the environmental impacts, beneficial and detrimental, for all alternatives including the do nothing alternative since the formal guidelines were published on August 24, 1971. A discussion of the beneficial effects of the selected alternative and the detrimental effects of the rejected alternative is not sufficient.

"The exploration of the alternatives should include an objective evaluation and analysis of the estimated costs (social and transportation), engineering factors, transportation requirements and environmental consequences."<sup>97</sup>



The description of each alternative includes the same information as that required for the corridor. The environmental consequences discussed for the corridor must be considered in greater detail for each alternative. The draft environmental statement must indicate that all alternatives are under consideration and that a specific alternative will be selected after the public hearing. The final environmental statement is prepared on the basis of the selected alternative. The final environmental impact statement may be included in the route location (or design) study as a self-sufficient section. If the route location (or design) study is not attached, the final environmental impact statement must discuss the data supporting the selected alternative and the reasons the other alternatives were rejected.-

The relationship between the local short term uses of the environment and long term productive effects must be evaluated. Short term effects (such as construction, changes in traffic patterns, taking of land and development, etc.) must be compared with long term effects (such as economic growth and productivity, changes in land use, environmental quality of the area, etc.).

Any irreversible and irretrievable commitments of resources as a result of the project must be discussed. This section refers to situations where endangered wildlife or plant material, or rare or valuable minerals are affected. The termination of a beneficial use of land, such as the taking of parkland, must be justified.

The final environmental impact statement includes all comments on the draft including environmental comments contained in the public hearing transcript and comments and recommendations on the environment from the A-95 Review agencies. The State highway department must describe the disposition of the comments and recommendations including the



revisions to the proposed project to resolve the objections, the reasons for rejecting the comments and recommendations, or the factors prohibiting the incorporation of the recommendations into the project.

A section 4(f) statement is required in addition to the environmental impact statement when parklands or historic sites are affected by the proposed project. The relationship between the project and park must be described in detail.<sup>98</sup> All alternatives to the project must be explained including the relative costs and engineering problems. The proposed route must be justified and accompanied by the statement that there are no feasible or prudent alternatives. The planning measures proposed to minimize the adverse effects of the project must also be described.

The Environmental Impact Statement Process in Indiana. In Indiana, the environmental impact statement procedures and policies are still in a flux. The environmental impact statements for the Interstate designs approved prior to February 1, 1971 and after January 1, 1970 resulted in negative declarations. When the interim guidelines were published in November of 1970, the displacement of a single family prevented a negative declaration for a new project. With the publication of the formal guidelines in August of 1971, several residents could be dislocated without an adverse impact on the environment. What constitutes an adverse environmental impact is still subject to variation in interpretation. New environmental guidelines are continually being developed. Most recently, the existing and anticipated noise levels must be considered in the environmental impact statement. The environmental impact statement process will take several more years to stabilize as any new program might.





The environmental impact statement process has succeeded in making environmental considerations a documented part of the planning and decision-making processes.

### Roadside Development

The Roadside Development Section of the Indiana State Highway Commission designs the rest areas and landscaping, including junkyard screening, for all of Indiana's highways; implements the Highway Beautification Act; is involved in billboard and junkyard control; and coordinates all the environmental impact statements for the Indiana State Highway Commission.

Evolution of Landscape Design. Indiana closely follows the AASHO policies and guides in landscape and rest park design. Federal landscape design guidelines are established on a regional basis (several States) after conferences with the individual State highway departments. The major changes in landscape design policy have been the shift from a spot roadside design concept to a comprehensive design concept and the increased emphasis on functional design.

When the Interstate Program began, the limited right-of-way restricted the landscape possibilities to isolated plantings. Since the increase in Interstate right-of-way width after 1967, comprehensive landscaping with group plantings became a possibility. Group plantings were preferable because of increased safety and reduced maintenance costs. Even though trees may be planted seventy to eighty feet from the pavement edge, Indiana felt that isolated, evenly spaced trees present more of a hazard than clumps of trees. Group plantings allow mowing around the plants reducing the complexity of mowing and the possibility of damage to plants. Group plantings also permit mulching to restrict competitive vegetation and reduces the hand work in maintenance. From a professional standpoint, the comprehensive



design concept provides greater design possibilities and assures superior landscaping. From an aesthetic viewpoint, group plantings appear more natural and have a greater visual impact than isolated evenly spaced plantings.

Landscaping is currently utilized for functional purposes rather than merely aesthetics. Safety, environmental and maintenance factors are prime considerations in landscape design.

The location of plantings to improve highway safety is a major benefit to highway users, particularly of the Interstate System. Plantings are utilized to outline hazardous areas such as bridge ends, culverts, the open spaces between twin bridge overpasses, dead end roads, curves, culverts and bridge piers. By emphasizing a hazard, it is more readily visible and recognizable by the driver. Plantings may also slow down the out of control vehicle in hazardous areas. Plantings are also used to block head light glare on dead end roads, on ramps, and on curves.

Although landscaping is used for a variety of environmental purposes, the primary purpose is erosion control. Indiana has increased the use of ground vegetation on slopes where a potential erosion problem might develop. All erosion problems that develop involve landscape design to correct a problem and prevent its reoccurrence. Nearly all construction projects have been programmed for staged seeding so that problems that develop can be corrected. Because noise abatement guidelines were to a certain extent retroactive, Indiana is preparing plans to screen portions of Interstate 465 to hold down the noise level. Indiana also uses landscaping to screen junkyards from the road and to screen rest areas from residential development.

Indiana continually searches for more appropriate landscape design practices to reduce maintenance work. The concept of entertaining by a variety of individuals displays





having a variety of colors, textures and forms has given way to a concept of functional - low maintenance planting. Indiana evaluates the landscaping and plantings of completed projects. Plantings which were found to be susceptible to insects, disease, frost and snow damage are no longer used. As plantings serve as snow fences to keep snow off of pavements, properly located plantings reduce the cost of snow removal.

Economics, particularly the reduction in funding since 1971, has caused changes in landscape design policy. Landscaping for aesthetic reasons only has been replaced by landscaping for functional and aesthetic reasons. To a large extent, changes in landscape design were caused by the Interstate Program because the Interstate System was the first system to have sufficient right-of-way for comprehensive landscape design and landscaping programs. The emphasis on safety and the environment has also made landscaping design more functional.

Landscaping and Scenic Enhancement. Landscaping and roadside development were first authorized as a part of the normal costs of construction for Federal Aid projects in 1938. Acquisition of strips of land adjacent to the highway to preserve the natural beauty in the highway corridor was authorized as a part of the normal costs of construction for Federal aid projects in 1940; an amount not to exceed three percent of the Federal aid funds apportioned to and matched by the State could be used to purchase scenic strips without being matched by the States. The emphasis on landscaping came with the passage of the Highway Beautification Act of 1965.

Federal aid funds may be utilized for the preliminary engineering, land acquisition and construction of landscape and roadside development including rest and recreation areas with sanitation and other facilities to accommodate the



public. Additional land may be acquired outside the normal right-of-way for safety rest areas and scenic overlooks. The Federal aid funds are only available on the matching basis of the system involved. Highway Trust Fund monies, however, cannot be utilized for billboard control, junkyard screening or the acquisition of scenic strips. Federal aid funds for these purposes are from the General Fund.

In addition to the State's annual apportionment from the Highway Trust Fund, the Highway Beautification Act of 1965 authorized an amount from the General Fund equal to three percent of the State's Federal aid highway apportionment for landscaping and roadside development within the highway right-of-way and for the purchase of scenic easements and improvement of strips of land to restore, preserve and enhance the scenic beauty adjacent to the highways, without the requirement of State matching funds. Funds not obligated within the fiscal year for which the funds were appropriated revert to the General Fund. Federal Trust funds under this section were not available for billboard control or junkyard screening.

When the Highway Beautification Act of 1965 was passed, there were complaints from highway enthusiasts who felt beautification was an expensive frill and from the highway engineers who thought roadside beautification efforts would conflict with safety measures and increase maintenance costs. The funding for scenic strips did not come from the Highway Trust Fund. Rest parks are important to highway safety, and federal funds are available on a matching basis for the federal aid system involved.

Highway beautification, however, has not conflicted with highway safety because highway engineers adhered to the AASHO guidelines that recommended the location of plantings of lethal thickness thirty feet or more beyond the pavement edge or the protection of plantings by guardrail. In very





accessible areas, Indiana avoided plantings or grouped plantings fifty to sixty feet from the pavement edge of the Interstate Route. There was never a conflict between safety and beautification in Indiana because safety rather than aesthetics governed the removal of hazardous obstructions. Only in isolated cases were there lethal plantings on the Interstate within the thirty-foot recovery area prior to the new AASHTO landscape guidelines of 1965. The problem of plantings and maintenance operations was resolved in Indiana by considering the maintenance operation in the design of landscaping. The grouping of plantings and the careful location of plantings that affect snow removal and control hold down maintenance costs. Landscaping is an essential element of erosion control and reduces the cost of erosion control.

The preservation of natural features along the roadside is an important element of the highway beautification program. As the right-of-way taking has become more liberal, there were additional areas where trees could be preserved. Trees outside of the construction limits are almost always preserved. In some cases, Indiana placed notes in the construction plans to assure that the trees were preserved. Tree preservation did not generally bother the contractor because it saved him the expense of tree removal. Only on occasions where tree removal might have given better access for construction did the contractor complain.

Within the construction limits, it was nearly impossible to preserve trees because of the cuts and fills. In the rest areas, tree wells have been used to preserve trees even though the grade was changed. Indiana has not utilized tree relocation methods because of the high initial cost of the equipment or the necessity to contract tree moving. Other than the fact that more mature trees give a finished look, seedlings can be planted at less expense and present a similar appearance within ten years. The recent practice of





mowing only to the ditch line enhances the environment because the unmowed area regenerates to its natural state, provides shelter for wildlife and improves erosion control.

Safety Rest Parks. Safety rest areas were intended "as a place for emergency stopping and for resting by motorists for short periods, with comfort and convenience facilities, such as drinking water, toilets and tables for meals, reasonably necessary to accommodate the traveling public."<sup>99</sup> Safety rest areas were not intended for overnight camping or recreational pursuits. Safety rest parks also lend themselves to the erection of visitor information centers where tourist services may be located. The visitor information centers further provide a substitute for billboards.

Initially, safety rest areas were to be reasonably spaced with respect to adjacent rest areas, approximately sixty to eighty minutes apart. In 1968, completed segments of the Interstate System were restudied for additional rest and recreation areas, for additional facilities within existing areas, and for additional landscape work within the right-of-way of the Interstate System. Since new Interstate guidelines had called for the spacing of safety rest areas based on a half hour of driving time, Indiana was able to almost double the number of safety rest areas on the Indiana Interstate System. [Refer to Figure 40, pg. 300].

Beside the spacing requirement, the factors considered in locating the rest park included the effect of the placement of ramps on the operational characteristics of the freeway (at least one mile from the nearest interchange ramp); the topography of the area; drainage; the availability of fresh water; the ability to dispose of sewage; the land use in the area (beyond the outer edges of suburban and urban areas and isolated from residential development); and the aesthetic character of the site (within or next to a



I-64

1. Evansville (Haubstadt)
2. Dale
3. Saint Croix
4. Corydon

I-65

5. Henryville (Clark County)
6. Columbus (only on east side)
7. Columbus (Taylorsville)
8. Thorntown
9. Wolcott (Remington)
10. Demotte

I-69

11. Alexandria (Summitville)
12. Markle
13. Auburn
14. Angola (only on west side)

I-70

15. W. Terre Haute (only on west side)
16. Prairie Creek (Brazil)
17. Mooresville
18. Greenfield
19. Richmond

I-74

20. Waynetown
21. Lizton
22. Shelbyville (only on north side)
23. Morris

TRI-STATE HIGHWAY (I-80)

INDIANA EAST-WEST TOLL

I-164 None

I-265 None

I-275 None

I-465 None

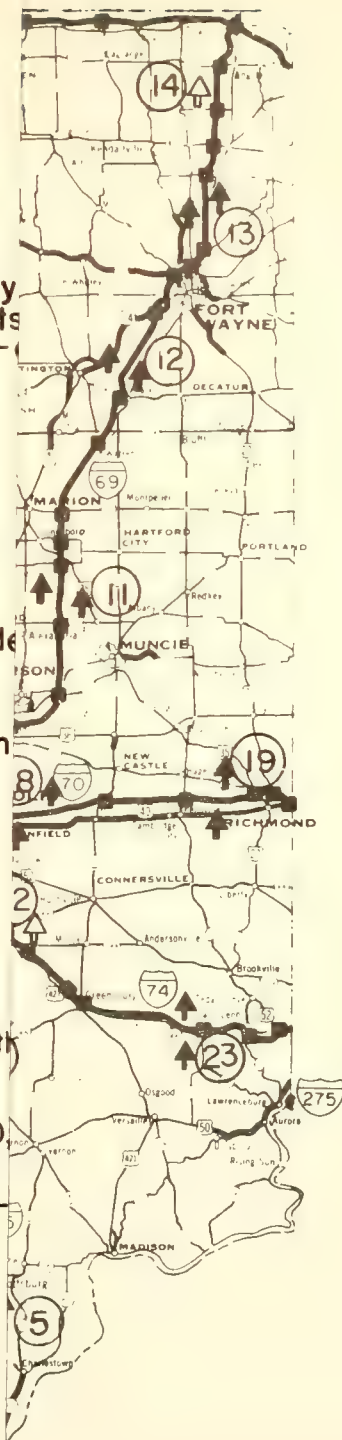


FIGURE 40. SAFETY





I-64

1. Evansville (Haubstadt)
2. Dale
3. Saint Croix
4. Corydon

I-65

5. Henryville (Clark County State Forest)
6. Columbus (only on eastside of interstate)
7. Columbus (Taylorsville—only on westside of interstate)
8. Thorntown
9. Wolcott (Remington)
10. Demotte

I-69

11. Alexandria (Summitville)
12. Markle
13. Auburn
14. Angola (only on westside of interstate)

I-70

15. W. Terre Haute (only on southside of interstate)
16. Prairie Creek (Brazil)
17. Mooresville
18. Greenfield
19. Richmond

I-74

20. Waynetown
21. Lizton
22. Shelbyville (only on northside of interstate)
23. Morris

TRI-STATE HIGHWAY (I-80,94, I-94) None

INDIANA EAST-WEST TOLL ROAD (I-90, I-80,90) None

I-164 None

I-265 None

I-275 None

I-465 None

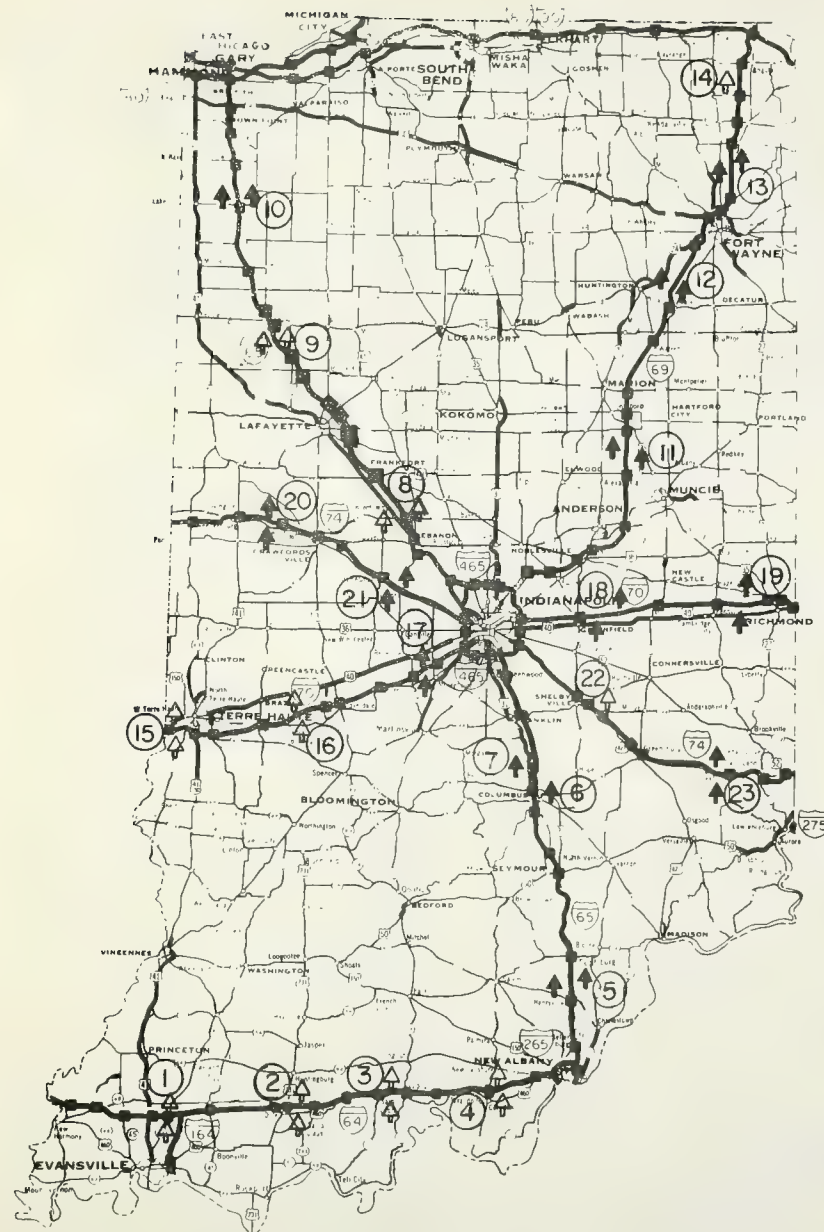


FIGURE 40. SAFETY REST PARKS



woods and free from man made features such as power transmission lines).

"Natural site values and advantages and conservation factors of special importance in site selection should be evaluated, the objective being to give maximum weight to the appropriateness of the site rather than to adhere to any fixed mileage between sites".<sup>100</sup>

At every safety rest park on the Interstate System, Indiana provided the following features: parking, cold water, warm water for washing, toilet facilities, picnic tables, grills, trash barrels, and a shelter house with bulletin board. The bulletin board includes a map of Indiana showing the position of the rest park, maps of other States, information on recreational areas in Indiana furnished by the Indiana Department of Natural Resources, and an historical report of the area.

Indiana has generally planned information or tourist centers at the first rest park on the Interstate Route within the State line. The information centers currently built are at Centerville on Interstate 70 near Richmond, at Henryville on Interstate 65 near Louisville and at Batesville on Interstate 74. The information center is a building with a large lobby; whereas, the outbound park has a small building without a lobby. The areas of the inbound and outbound parks are the same size although a larger parking area is provided for the park with the information center. Due to the discovery that the outbound park facilities are utilized as much if not more than the inbound parks, Indiana is adding lobbies to the older outbound parks. Information centers are being planned for the other Interstate Routes.

The Division of Tourism of the Indiana Department of Commerce has trailers which are shifted from park to park to provide tourist information during the summer. Limited tourist promotion funding has prevented continuous coverage of all information centers on the Interstate. The Indiana





State Highway Commission and Department of Commerce do not have a formal agreement for joint use of the information centers.

Depending on the topography, the size of the Interstate rest areas ranges from ten to forty acres and averages approximately twenty acres. The land is a very small part of the total park cost - \$300 per acre in rural areas to \$600 per acre for good farm land near urban areas. The total cost of an Interstate rest park pair varies from \$600,000 to \$800,000 including \$200,000 to \$300,000 for parking and ramps and \$300,000 to \$400,000 for a pair of buildings with a sewage treatment plant, wells and other facilities. The operating cost for the Interstate safety rest parks is extremely high. The newest and largest Interstate safety rest areas must be attended at all hours requiring ten to eleven full time employees including a sewage treatment plant operator plus additional labor to pick up trash.

Scenic Overlooks. Scenic overlooks are small rest areas which permit the traveling public to stop for a short time to view scenery of outstanding interest and beauty. The size, number and location of scenic overlooks depend on the character of the surrounding area and the operating characteristics of the highway. Scenic outlooks are merely to supplement the existing safety rest parks and may lack comfort and convenience facilities. Indiana is currently acquiring three scenic overlooks, but none are on the Interstate System.

Scenic Strips. Indiana has purchased over twenty scenic strips on the Interstate and Primary Systems and many more are planned. On Interstate 74, a consultant reviewed aerial photography to select, probable strips and surveyed the site for suitability. Although Indiana can condemn land for scenic strips as well as rest parks, Indiana follows a policy of voluntary sale on the part of the owner for cost and public relation reasons.





Control of Outdoor Advertising. The first Federal provisions for outdoor advertising control were enacted by the Federal Aid Highway Act of 1958. Congress declared that the erection and maintenance of outdoor advertising signs, displays and devices adjacent to the Interstate System should be controlled to promote the safety, convenience and enjoyment of public travel, to preserve natural beauty, and to protect the public investment in the Interstate System. All signs on the Interstate right-of-way and within six hundred and sixty feet of the edge of the right-of-way were to be regulated according to national standards developed by the Secretary of Commerce. The national standards permitted only the following four types of signs:

"(1) Directional or other official signs or notices that are required or authorized by law.

(2) Signs advertising the sale or lease of the property upon which they are located.

(3) Signs erected or maintained pursuant to authorization or permitted under State law, and not inconsistent with the national policy and standards of this section, advertising activities being conducted at a location within twelve miles of the point at which such signs are located.

(4) Signs erected or maintained pursuant to authorization in State law and not inconsistent with the national policy and standards of this section, and designated to give information in the specific interest of the traveling public".<sup>101</sup>

As an incentive for States to enter into agreements with the Secretary of Commerce to provide advertising controls along the Interstate System, the Federal government offered a bonus from the General Fund equal to one-half percent of the Federal highway apportionment to the States. Whenever a State acquired the right to advertise in an area adjacent to the Interstate through eminent domain, the cost of compensation was considered part of the construction cost. The Federal share of the compensation was reimbursable, provided the cost did not exceed five percent of the right-of-way cost. When the offer expired on June 30, 1965, only twenty-five States, excluding Indiana, had signed agreements to control advertising.



The Highway Beautification Act of 1965 provided stronger and broader legislation than the Federal Aid Highway Act of 1958. The control of outdoor advertising was extended to highways in the Primary System. States that failed to sign an agreement to control advertising by January 1, 1968 were to be penalized by the withholding of ten percent of their Federal aid highway apportionment. To be in compliance with the Highway Beautification Act of 1965, the States had to provide for the control of future signs such that they were permitted only in the areas and under the conditions prescribed by the Act, and had to establish a program for the removal of nonconforming signs.

Under the current standards, the States were required to control outdoor advertising within six hundred and sixty feet of the right-of-way of all Federal Aid Primary highways, which included the Interstate System. Subject to the standards on size, spacing, lighting and zoning established by the Secretary of Transportation, only the following signs were permitted:

"(a) Directional and other official signs, including signs and notices pertaining to natural wonders and scenic or historical attractions. These signs shall conform to national standards promulgated by the Secretary.

(b) Signs advertising the sale or lease of property upon which they are located.

(c) Signs advertising activities upon the property on which they are located.

(d) Signs erected and maintained in areas which are zoned industrial or commercial under State law, or in unzoned industrial or commercial areas, and which do not violate the standards of size, lighting and spacing as determined by the agreement between the Secretary and the State. This subsection is not applicable to on-premises signs referred to in (b) and (c) above".<sup>102</sup>

According to the Highway Environment Reference Book, motorist service signs giving specific gas, food and lodging information fall under directional signs.<sup>103</sup> The Federal government would pay seventy-five percent of the compensation





under State law for the removal of signs lawfully in existence on October 22, 1965, lawfully on any highway incorporated into the Interstate or Primary System on or after October 22, 1965 and before January 1, 1968, or lawfully erected after January 1, 1968 which subsequently become nonconforming. Signs lawfully in existence on September 1, 1965 which were nonconforming had to be removed by July 1, 1970. Any other lawfully erected sign which became nonconforming need not be removed until the end of the fifth year of its nonconformance.

Indiana made an inventory of all signs on the Interstate and Primary System in 1966 and passed legislation to control outdoor advertising in 1967. However, the Indiana Billboard Control Act of 1967 failed to comply with minimum Federal standards on the definition of unzoned commercial and industrial areas. Fortunately, the Federal Congress did not provide the monies to enforce the Highway Beautification Act; and a moratorium was declared without penalty to the States. Since the Federal Aid Highway Act of 1970 authorized the required funding in limited amounts from the General Fund, the three year moratorium was lifted. On May 7, 1971 the Indiana Billboard Control Act of 1967 was amended such that the Governor was given the power to make an agreement with the Secretary of Transportation sufficient to bring the Act to minimum compliance with Federal standards. An agreement was signed between Governor Whitcomb and Secretary of Transportation Volpe on August 4, 1971.

Indiana's failure to comply earlier may have been due to the lack of specific Federal standards. The Federal law was written such that local custom would govern in the establishment of outdoor advertising controls. The Federal Highway Administration evaluated the content of the State's controls after the State had written an act to meet specific circumstances in the State.



The Indiana State Highway Commission has removed some billboards under the provisions of the Highway Beautification Act of 1966, but no payments have been made. When billboards were within the Interstate right-of-way, the owners were compensated for their removal. The Indiana State Highway has determined the billboards that have to be removed and has submitted programs for scheduling the removal of billboards along the Interstate System. As of April of 1972, initiation of the removal action was pending the establishment of a compensation schedule by the Indiana State Highway Commission in cooperation with the Federal Highway Administration and billboard industry. In the interim, notices were sent to companies to remove, without compensation, signs that were erected unlawfully after October of 1971. (The agreement between the Governor and the Secretary of Transportation was effective sixty days after the signing).

The Indiana Billboard Control Act included the provision that Indiana will participate in the cost of compensation for billboard removal only if the Federal government will participate. Consequently, signs erected between October 22, 1965 and October 4, 1971 will not be removed, even though they have become nonconforming, because the Federal government will not participate in the cost of removing signs erected within these dates. Thus, the Indiana State Highway Commission will only eliminate nonconforming signs recorded on the 1966 inventory (which has an effective date of October 22, 1965) and will prevent illegal signs from being erected after October 4, 1971.

To aid in the control of billboards, the Indiana State Highway Commission was attempting to establish a permit system in April of 1972. However, opposition by the billboard industry may result in the signs merely being registered. However, the Federal Highway Administration has been pressing for the permit system as it anticipates more stringent regulations in the future and felt that annual permits may not be automatically renewed as a consequence.





Control of Junkyards. The Highway Beautification Act of 1965 also called for the regulation of the establishment, use and maintenance of junkyards adjacent to the Interstate and Primary Systems "to protect the public investment in such highways, to promote the safety and recreational value of public travel, and to preserve natural beauty".<sup>104</sup> States that failed to establish effective control by January 1, 1968 were to be penalized by the withholding of ten percent of their Federal aid highway apportionment.

All junkyards, auto graveyards, and scrap metal processing facilities, except those in legally zoned industrial areas or in unzoned industrial areas established by the State with approval of the Secretary, were to be screened by shrubbery or fence if they were within one thousand feet of the edge of the right-of-way and visible from the highway. If they could not be effectively screened, they were to be removed. The Federal government would participate with General funds in seventy-five percent of the cost of landscaping and screening junkyards; the use of funds from the Highway Trust Fund was prohibited. Owners were to be compensated for the relocation, removal or disposal of the junkyards lawfully in existence on October 22, 1965, lawfully along a highway incorporated into the Interstate or Primary System on or after October 22, 1965 and before January 1, 1968, and lawfully established on or after January 1, 1968 which subsequently became nonconforming. Any junkyard in existence on October 22, 1965 that did not conform and could not be practically screened was not required to be removed until July 1, 1970.

"Any junkyard lawfully established on or after January 1, 1968, which later becomes nonconforming and which as a practical matter cannot be screened, must be removed within a reasonable time but not later than two years after the date it becomes nonconforming".<sup>105</sup>





The Indiana Highway Junkyard Control Act of 1967 and an amendment in 1968 brought Indiana into compliance with the federal requirements established through the Highway Beautification Act of 1965. The junkyard inventory was made in 1966. Indiana has both removed and screened junkyards under the junkyard control program. Several junkyards have disappeared due to the natural attrition of the owners. Through local zoning, the owner was not able to resell the nonconforming use or was forced out of business.

The decision to screen or remove a junkyard depends on economics. Junkyards which cannot be economically screened, such as those below an overpass, are removed.

### Land Acquisition

The process of land acquisition has undergone a greater evolution than any other process in the highway transportation field. During the Interstate Program, land acquisition has changed from one of the least sophisticated processes with few established policies and procedures to one of the most sophisticated processes with an extensive set of policies and procedures.

The Division of Land Acquisition of the Indiana State Highway Commission was first involved in the Interstate projects at the highway location stage. In a supporting role, the Division provided documentation on the right-of-way costs of the various alternatives. When the final location studies were completed, the drawings were submitted to the Division for concurrence in the right-of-way limits, the access control points and frontage roads.

The Division of Land Acquisition is no longer involved in Interstate projects until the design study is completed. Upon completion of the design study by the Division of Design, the right-of-way plans are forwarded to the Division of Land Acquisition for review. After the design public hearing is



held and the transcript is approved by the Federal Highway Administration, the incidental costs (abstracting, R/W engineering, appraising, etc.) of acquiring the right-of-way are programmed for Federal reimbursement. Preliminary right-of-way cost estimates were determined and reported to FHWA in program documentation prior to approval of incidental costs. During right-of-way engineering, the preliminary right-of-way plans are transformed into the final right-of-way plans and the final right-of-way cost estimates are completed. After FHWA approval of the final right-of-way plans, FHWA approves "acquisition costs" and the actual process of land acquisition begins.

Evolution of the Land Acquisition Process. Prior to 1955, the land acquisition process was that which had developed over the last twenty years or more. When the right-of-way plans were submitted to the Division of Land Acquisition, abstractors were sent to the county seats of the project to determine the ownership and interests in the property to be acquired. At this time no engineering section, appraisal section or relocation section existed in the Division of Land Acquisition; and the right-of-way was merely described by the centerline of the project. With the title information and a set of construction plans, the buyer proceeded to examine the parcel; determine what land was selling for in the area by word of mouth; wrote the centerline description; computed the area of the take; and developed an offer for the take based on the area of the take, the cost of improvements within the right-of-way and a cursory review of prices in the area. Then, the buyer negotiated or "horse traded" without an appraisal to purchase the required right-of-way. This process was utilized for both rural and urban projects.

Two interrelated factors were to revolutionize the land acquisition process: the utilization of Federal aid funds





for right-of-way costs and the subsequent Federal policy and procedure memoranda that eventually required one offer of the fair market value to the owner. During the administration of Governor Craig, a study on State governmental organization by a consultant recommended the use of Federal aid funds in right-of-way acquisition. As a part of the Appropriations Act of 1955, the Indiana legislature required that all right-of-way be purchased with Federal aid participation. This altered the Indiana State Highway Department practice of utilizing Federal aid funds only for construction.

With Federal participation in the costs of right-of-way came the Federal policy and procedure memoranda that required the State to make an appraisal of all property to be acquired. Initially, the appraisals were opinions without documentation which were intended to protect the Federal government from over estimates of value (not necessarily the owner from low offers). Although the negotiator had knowledge of the appraisal, he still utilized the accepted negotiation practice of "horse trading". This practice was considered unfair to the owner because the unknowledgeable owner might receive less than the fair market value for the property being acquired. In 1960, this inequity was corrected nationally by the requirement that only one offer of the fair market value be made to the property owner.

In 1964, the Land Acquisition Division of the Bureau of Public Roads became dissatisfied with the land acquisition procedures being utilized in many States. The subsequent review by the Bureau of Public Roads resulted in the reorganization of the Indiana State Highway Commission Division of Land Acquisition with qualifications established for all the personnel and several of the personnel placed under the merit system.

On July 1, 1964, the Bureau of Public Roads refused to approve many parcels for reimbursement on the basis that the



appraisal documentation was not adequate. Federal funds for right-of-way costs were withheld on a project-by-project basis in many States, including Indiana. The Indiana State Highway Commission felt the action by the Bureau of Public Roads was unwarranted because Federal personnel were in contact with the land acquisition process on a day to day basis and had not raised any objection to Indiana's method of operations. At the time the Bureau of Public Roads made the announcement, few projects in Indiana had been audited by the Bureau of Public Roads, and nearly four hundred projects were awaiting Federal review and audit.

To resolve the situation, the Bureau of Public Roads required a reevaluation of the appraisals. A sample, including all parcels above \$100,000, was taken of all parcels appraised and purchased before July 1, 1964. The parcels in the sample were reappraised, and the percentage difference between the old and new appraisal was applied to all parcels appraised and purchased before July 1, 1964. Indiana subsequently lost 7.3 percent of the Federal participation in the right-of-way cost.

All parcels appraised by July 1, 1964 and purchased after July 1, 1964 were reappraised. Since the Bureau of Public Roads only participated in the amount of the reappraisal, Indiana had to pay that portion of the cost above the reappraised value. In effect, the State was penalized for its unsophisticated appraisal methods of earlier years even though the State, as well as other, had followed the Federal policies and procedures of that time.

Since 1964, there have been no dramatic changes in the land acquisition process. Nevertheless, the documentation of appraisals has grown more detailed over time. Appraisals have to be supported by documentation based on a market analysis and can no longer be supported merely by opinion as they were prior to 1964.





The Practice of Land Acquisition. The appraisal process has evolved in a manner to insure increased impartiality in land acquisition. Initially, the buyer also did the appraising. In 1956, a one page opinion appraisal was necessary. By 1964, the appraisal had to be documented. Currently, an appraisal review process exists by which the fair market value is established by the review appraiser on the basis of one or more appraisals. The review appraiser checks the market data comparables used in each appraisal and makes a field check before establishing the fair market value. When the appraisal exceeds \$25,000 (\$50,000 after April 7, 1970), the chief review appraiser also evaluates the appraisal.

The State is required to make at least one appraisal for each parcel to be acquired or damaged. When the value exceeds \$25,000 (\$50,000 after April 7, 1970), the State is required to make at least two appraisals. The Federal government will participate in only one appraisal if the value is \$500 or less (\$1000 after April 7, 1970), two appraisals if the value exceeds \$500, and two additional appraisals in condemnation cases. Indiana uses a short appraisal form for appraisals that do not exceed \$2,500 and the Federal government permits nominal value appraisals (informal appraisals) for values that do not exceed \$500 (\$1000 after April 7, 1970).

The Indiana State Highway Commission closely follows State law and the Federal Highway Administration policy and procedure memorandum "Right-of-Way Procedures (Appraisal and Appraisal Review)" in making appraisals. The highest and best use of the land is the primary factor in determining the value of property. Indiana utilizes the market and cost approach to determine appraisal values. The market approach, based on comparable sales, is the preferred approach when it is applicable. The cost approach, the cost to construct a comparable structure less depreciation, is generally





used to support the market value when improvements are involved. Severance damage, the percentage reduction in the value of the remainder of property as a result of a partial taking (severance) is based on the before and after method of valuation of sales of other remainders.

Overall experience and sophistication has made the damage awards closer to the actual loss in resale value of the property due to the partial taking. In the situation of landlocking, damages are paid in the amount the value was depressed due to landlocking. In the early 1960's, the damage due to landlocking was found to be eighty percent with one abutting owner, fifty percent with two abutting owners, and twenty-five to thirty percent with three abutting owners. Presently, Indiana is able to support what it pays for landlocking from economic studies of sales of other landlocked properties. In arriving at the fair market value, reference is always made to comparable sales; an opinion is no longer adequate.

Initially the appraisal and negotiation functions were both performed by the buyer. Since the early part of the Interstate Program, appraisers have no longer been used for negotiators. When the offer of the fair market value became mandatory in 1960, the negotiator merely performed the role of an agent since there was no negotiation.

When the negotiator contacted the owner, he provided a packet with loan and relocation information; checked the title certificate for accuracy; explained the highway plans and the area needed for construction; and made a firm offer of the fair market value to the property owner explaining to the owner his right to refuse the offer and the eminent domain procedures. Since there was no separate Relocation Section in the Division of Land Acquisition prior to 1969, the negotiator completed the necessary relocation forms and gave the owner the 180-day (90-day since September of 1968) notice to vacate. When the Relocation Section was formed,



the relocation agent contacted the owner within fifteen days of the negotiator, provided the relocation information, completed the relocation forms, and served the 90-day notice to vacate.

If the owner refused the fair market value offer, an administrative adjustment (settlement) was possible before the State resorted to condemnation. Since 1960, (when the fair market value was first offered) there have been few administrative settlements and all had to be supported by documentation. In all cases, the Chief of the Division of Land Acquisition is authorized to approve settlements for appraisals of \$1000 or less. The Executive Director of the Indiana State Highway Commission has to approve settlements for appraisals of \$25,000 or less; the Chairman of the Indiana State Highway Commission approves settlements of \$50,000 or less, and the Indiana State Highway Commission approves settlements above \$50,000.

If a settlement is not reached through the adjustment process, the Chief of the Division of Land Acquisition makes the final recommendation to institute condemnation proceedings. The owner is given notice that the offer will be held open for ten days and then the file will be transmitted to the Attorney General for condemnation. It often takes two (2) months before the complaint is filed in court. The State deposits with the Clerk of the Court the full amount of the court appointed appraisers' award. Interest is paid on any of these funds not withdrawn by the owner. The Federal Highway Administration has not participated in interest payments since December 23, 1965. Within ten days of the court appraisal, either side has the right to take exception to the court appointed appraiser's award. Initially, if the owner drew down on the money posted by the State he waived his right to exception. At present, the owner is permitted to draw down an amount equal to the State's offer without posting bond himself or sacrificing some of his rights in court. When the State cannot acquire lands by purchase at





fair market value it has no alternative but to acquire by condemnation, even though this is costlier in most cases.

If local courts prevent the condemnation of land, the State may request the Federal Highway Administration to acquire land for the Interstate. This procedure was exercised only once by Indiana in the case of the interchange at Interstate 65 and U.S. 30.

The Interstate Program was directly responsible for the evolution in the current practice of land acquisition. Because most States had initially preferred to use Federal aid funds on construction rather than right-of-way acquisition, they would not have been exposed to the standards of land acquisition required by the Federal government. The Interstate Program provided funds within a fixed time span which could be used on all phases of Interstate construction, were an addition to existing funds, required only ten percent State matching funds, and were nontransferrable to other systems. Furthermore, FHWA requires adherence to its Right-of-way and Relocation Regulations if any activity on a project is to receive federal-aid. The requirements for appraisals and appraisal documentation reduced the likelihood of wide variations in market value determinations along a given project.

Access Control. In 1938, the national study Toll Roads and Free Roads established the importance of access control to protect the nation's major highways for the use they were intended - the moving of traffic, not property access. In 1945, the State of Indiana passed the necessary legislation to enable the designation of highways on existing and new right-of-way as access controlled, the elimination of access points to new or existing highways so designated, and the purchase of right-of-way and access rights for access controlled highways.<sup>106</sup> The mere designation of routes as access controlled by resolution proved inadequate to control



commercial development and pointed out the necessity to purchase the access rights. In the early 1950's, when commercial development rather than traffic operation was allowed to dictate the character of urban bypasses such as Kokomo, Lafayette and SR100, the Indiana State Highway Commission recognized that access control was needed to protect the public investment. The 1955 Indiana Legislature required that all future bypasses be designated as access controlled.

When the Interstate Program began, Indiana had no problem in meeting the access control requirements; however, States that lacked the adequate enabling legislation had to request the Federal government to purchase the Interstate right-of-way. The Indiana State Highway Commission has purchased access rights on old right-of-way, but only when the highway on the old right-of-way was upgraded or improved. When a highway is now built on new right-of-way, Indiana generally purchases the access rights to protect the public investment.

Payments for access rights are based on the loss in property value, which reflects the loss of direct access, as determined from prior sales of land where access has also been denied. When the property has another access, loss of an access point may be compensated by severance damages. In the case of a highway on a new location, the access rights are purchased when the right-of-way is purchased. If the loss in value of a property exceeds the cost of constructing a new public access road, the State will construct a new access road.

Advance Land Acquisition. The Federal Aid Highway Act of 1956 permitted the use of the apportionment to a State for advance land acquisition provided an agreement was signed with the Secretary and construction commenced on the right-of-way within five years (seven years with an amendment in 1959). Not until 1968 did the Federal government establish a revolving fund for advanced land acquisition. The Federal Aid Highway Act of 1968 transferred funds from the Highway



Trust Fund to the Right Of Way Revolving Fund for fiscal years 1970 to 1972.

The States were apportioned an amount from the revolving fund based on the same percentage of total apportionment for other Federal aid highways funds. The States had to obligate the revolving funds apportioned before October 1 of the fiscal year of the apportionment, or the funds reverted to the revolving fund for use by other States. The right-of-way revolving funds could be utilized for all right-of-way and relocation expenses, provided construction did not commence in less than two years and did commence within seven years of the advancement of funds. When the construction did not commence before the termination date or when the final plans, specifications and estimates were approved for construction, the Right Of Way Revolving Fund would be credited with an amount equal to the Federal share of the funds advanced out of the Federal aid highway funds apportioned to the State and reimbursed by the State for the non-Federal share advanced.

Overview of Advanced Land Acquisition. The advanced acquisition of right-of-way is advantageous because it allows the State to "(1) acquire needed right-of-way before development occurs, thus reducing acquisition costs, (2) have right-of-way available when construction is necessary (3) minimize undue hardship to those who need to dispose of their property after the location becomes known and ready purchasers are not available", (4) minimize the hardship to those who must relocate by giving them more time to find new housing, and (5) minimize the necessity of building replacement housing.<sup>107</sup> The major draw back to the utilization of advance land acquisition is the limitation of funds available. Present funding limits projects to overcoming of present deficiencies and precludes the use of the limited funds for advance land acquisition for future projects to overcome future deficiencies.





Even though advance land acquisition would reduce right-of-way costs, the State cannot tie up limited funds in land for future construction when the funds are needed for right-of-way and construction elsewhere today. In other words, every dollar spent for right-of-way for future construction reduces the amount of funds available for construction needed today. The existing level of man power and work load of the Indiana State Highway Commission further precludes advance design and land acquisition. Even if advance design and land acquisition were feasible, the design plans would probably become obsolete before construction was possible due to the rapid evolution in design standards.

However, Indiana utilized advanced land acquisition in one major instance. For the Interstate routes within Interstate 465 in Indianapolis, approximately thirty-five percent of required right-of-way was purchased over a four year period starting in 1964 on a "willing seller basis" prior to scheduled land acquisition. Although the design plans for the routes had not been completed to the point that the right-of-way outline could be determine from the construction limits, an acquisition program was developed on the basis of the average width of the right-of-way. Because of the large volume of acquisition needed for the Interstates within Interstate 465, the Bureau of Public Roads authorized the acquisition of total takings based on the average right-of-way width. Under the Willing Seller Program, the owners and renters were not required to vacate the property 180 days after the acquisition of the property. If the owner did not move within thirty days, the State entered into a rental agreement of a nominal amount based on the amount the State paid for the property. When renters were involved, the State entered into a lease agreement with the tenants until they could relocate.



One of the major reasons the Willing Seller Program of advanced land acquisition was instituted was to give more time for the orderly relocation of people in the dense urban area. During this period no relocation entitlements, not even moving expense compensation, existed. Without the advance land acquisition program, the Indiana State Highway Commission felt that Interstate construction would have been delayed by intensive relocation problems. If the State had begun with scheduled acquisition in 1968, the relocation regulations under the 1968 Federal law would have necessitated the construction of replacement housing by the State.

The Indiana State Highway Commission also utilized advanced land acquisition for a few Primary System projects in 1968 and 1969. On other projects, the new design public hearing requirement and relocation report requirements delayed the transmittal of right-of-way plans to the Division of Land Acquisition for eighteen to twenty-four months. Consequently, the advance acquisition projects were let for construction first because they were the only projects on which the right-of-way had been cleared.

In the latter stages of the Interstate Program, general land acquisition took on the appearance of advanced land acquisition because funding reductions put off the expected construction lettings. Indiana has followed a general policy of acquiring Interstate right-of-way as soon as the right-of-way plans were available. Since almost all the land was acquired for the Interstate System by 1972, the Indiana State Highway has been able to devote more time to other projects and has begun to stretch out the lead time of right-of-way acquisition (the time between the receipt of the right-of-way plans for acquisition and the letting of the project for construction).

Indiana has not utilized any funds from the Federal Right of Way Revolving Fund of 1968 because of the general





policy to utilize its limited funds to overcome existing deficiencies and the lack of State enabling legislation. The seven-year limitation on advanced land acquisition poses some problems in that the average development and implementation life of projects is now approaching seven years.

If the power of eminent domain is utilized in advanced land acquisition for highways, corridor and design public hearings are necessary. By the time the public hearings are held and processed, there is little time advantage for advanced land acquisition using Federal funds. If land is purchased on a "willing seller basis" for a highway corridor without the corridor public hearing, there might also be less public input into the corridor alternative evaluation process. Another problem of advanced acquisition is that the Federal government will only participate in the cost of land actually utilized for highway construction. To circumvent some of these problems, the State would have to create a revolving fund of its own to purchase land for public projects on a "willing seller basis". This means the State would have to overcome public opposition to the State's entry into the real estate business.

Alternatives to Advanced Land Acquisition. Instead of the establishment of a State revolving fund for advance acquisition or the passage of an enabling act to utilize funds from the Federal Right of Way Revolving Fund, the Indiana State Highway Commission utilized several other procedures in the Interstate Program to bring about a limited degree of advanced land acquisition. There was a conscious attempt to stretch out the land acquisition lead time on construction by completing and forwarding the preliminary right-of-way plans to the Division of Land Acquisition as soon as possible. The necessity of the design public hearing in 1969 generally eliminated this procedure because right-of-way engineering could not be programmed until after the design hearing and design study had been approved.



However, the Federal Highway Administration allowed right-of-way acquisition prior to the design hearing under certain circumstances. Full takings might be authorized by the Federal Highway Administration Division Engineer after the corridor hearing and final location were approved, provided the entire parcel would be required for the highway right-of-way and the taking was necessary to provide for the orderly and humane relocation of those to be displaced.

Partial takings could not be authorized except under the circumstances which follow. Whole and partial takings may be authorized, after the corridor hearing and final location are approved by the Division Engineer, as protective buying where the State "demonstrated to the satisfaction of the Division Engineer that the action is necessary in the public interest to (a) forestall proposed commercial and residential development which would utilize the proposed highway right-of-way or adversely affect the highway design or (b) result in a substantial dollar savings in the cost of right-of-way acquisition over that which would have been incurred had the right-of-way been acquired at a later date."<sup>108</sup>

Whole or partial takings may be authorized by the Division Engineer after the corridor hearing and final location are approved where "the property owner would suffer undue hardship if acquisition were deferred until after the design public hearing".<sup>109</sup> Indiana has taken advantage of all these measures during the Interstate Program. The Willing Seller Program on the Interstate Routes in Indianapolis was an example of whole takings for relocation and owner hardship reasons. Protective buying was used on several Interstate interchange crossroads to protect the right-of-way until the crossroads could be upgraded to a logical termini.

The State has also utilized its regulatory powers to prevent improvements on proposed Interstate Routes. The Land Acquisition Statutes of 1957 provided the Indiana State Highway Commission with limited powers to prohibit improvements





on proposed routes. As soon as the centerline of the project had been established and the plans had been developed to the point that an average right-of-way width could be determined, the right-of-way plans were filed as a matter of public record at the county seat in which the project was located. The right-of-way plans were accompanied by a notice requiring the owners, within the intended right-of-way of the facility, to notify the Indiana State Highway Commission of any intent to alter the highest and best use of the land or to build any structure within the future right-of-way.

When the owner notified the ISHC of his intent to improve the property, the Indiana State Highway Commission had 90 days to purchase or condemn the property. The Indiana State Highway Commission had originally desired to control improvement three to five years in advance and to file the right-of-way plans with the county at the earliest time possible. However, more than 90 days was found to be interference with the owner's legal right to use his property.

The Indiana State Highway Commission also cooperated with local governments to restrict development on proposed routes in urban areas. Zoning controls and thoroughfare ordinances allowed local governments to reserve right-of-way for proposed routes to a varying degree. However, zoning has limited power in restricting development. A zoning, subdivision or thoroughfare ordinances may state that there will be so many feet of right-of-way reserved for a specified time period for a proposed public improvement and that development will be setback from the right-of-way line of the proposed public improvement, but cannot insure that right-of-way will remain undeveloped to the time construction begins. Unless the right-of-way is dedicated for the highway or purchased, someone may utilize the proposed right-of-way for another purpose when the time limitation for restricting development runs out. The Indiana State Highway Commission ,





however, has had good cooperation with local planning authorities in the effort to disapprove subdivision plats that failed to reserve right-of-way for the Interstate or to persuade future industries and developers to reserve right-of-way.

Excess Condemnation. The Indiana State Highway Commission has had limited excess condemnation powers since 1957. If the severance damages to the remainder of a taking exceeded the value of the residue, the residue could be purchased. The original concept was based on the belief that the Interstate Program might bisect farms causing high severance damages. These damages could be eliminated by purchasing the farm land that was separated and reselling it to an abutting owner who also had separated land. In other words, the State could expedite the transfer of lands to make the several property owners whole again. The Indiana legislature defeated this purpose by requiring that the severed land be offered back to the original owner at a price not less the usual land disposal price, if that failed, the land could be offered to an abutting owner.

The Indiana State Highway Commission went back to the legislature to get permission to combine residues on either side of the facility to make them a more economical unit for resale, but to no avail. In Indiana the trading of properties on either side of the facility or the combining of residuals was up to the individual farmer. If the farmers cooperated, they could get severance damages and trade properties to their operational advantage. Other States have facilitated the transfer of severed properties, thus, reducing or eliminating severance damages.

Because the Indiana law did not facilitate the transfer of residuals, the Indiana State Highway Commission held excess taking to a minimum because of the problem of disposal. Excess condemnation was utilized where residuals were landlocked or uneconomical or when it was in the best public



interest to make an offer for the entire parcel rather than pay damages on the residue. The Indiana State Highway Commission only purchased residuals by offer and not condemnation.

Generally the Federal government would participate in the cost of the taking and the damages, but not in the purchase of the residual via excess condemnation. If the State did purchase excess land, the Federal government had no interest in the residual. In such instances, the State hoped to get the residue cost back through the sale of the remainder.

In March of 1969, the Federal government established an alternate procedure for reimbursing the State for the cost of right-of-way. The Federal government would participate in the portion of the entire tract utilized in construction plus the difference between the sale price and the initial cost of the excess property, provided the former is the lesser amount. The difference in price was considered the damages to the remainder by the Federal government. If the State failed to dispose of the excess, the Federal government considered that no damages accrued to the excess retained by the State and would only participate in the portion of the taking used in construction.

Recently, the State has been required by the Federal Highway Administration to offer to acquire the entire parcel if the residue would be uneconomical. In such cases the Federal government would participate in the cost of the uneconomic remnant. The remnant could not be purchased by condemnation.

Indiana has no powers of excess condemnation other than the limited power just described. The purchase of land adjacent to the highway to prevent windfall profits to a few or to recoup the increase in the value of abutting land from the public investment in the highway is not possible in Indiana.





The Indiana State Highway Commission can only purchase land for use as public highways. The purchase of rest parks and scenic strips is generally through offer although the State can condemn such property. If Indiana did broaden the definition of excess condemnation to include the purchase of land adjacent to the right-of-way the State would again have to overcome the opponents to the State's entrance into the real estate business.

### Relocation

The construction of new highways has always necessitated the displacement of families and businesses. Some of those displaced were forced to bear social and economic hardships for the benefit of the general public. The Federal Aid Highway Act of 1962 required all States to provide relocation advisory assistance for persons displaced by the acquisition or clearance of right-of-way for Federal aid highway construction and authorized relocation payments for moving expenses of up to \$200 for residential moves and \$3000 for business, farm operation, or nonprofit organization moves. The maximum distance allowable for a business or nonprofit organization move was fifty miles. The 1962 provisions also allowed a fixed payment not to exceed \$200, to displaced persons in lieu of reasonable and necessary moving expense. The States were not required to pay relocation payments if such was not authorized by State law. Most States, including Indiana, lacked the enabling legislation to make relocation payments for moving expenses; thus only relocation advisory assistance was provided in these States.

The Federal Aid Highway Act of 1966 directed the Secretary of Commerce to make a relocation assistance study by July 1, 1967 to determine the need for additional relocation payments or financial assistance, the feasibility of construction replacement housing, and the costs and funding



for replacement housing. In 1967, Indiana passed a comprehensive relocation assistance act that required the Highway Commission and colleges acquiring real property to establish an advisory assistance program for those displaced and authorized relocation payments covering moving expenses, dislocation allowances and replacement housing.

In response to the Highway Relocation Assistance Study of 1967, Congress drastically expanded relocation assistance for those displaced by Federal aid highway projects through the Federal Aid Highway Act of 1968. This act made relocation assistance payments mandatory; however, the Federal government promised to pay one hundred percent of the first \$25,000 of such payments to any person displaced until July 1, 1970. On July 1, 1970, all States were to be in compliance with the relocation requirements of the Federal Aid Highway Act of 1968; and the Federal share of the relocation payments would revert to the Federal share of the project costs.

On January 2, 1971, Congress passed the Uniform Relocation Assistance and Real Property Acquisition Policies Act of 1970 which extended the relocation assistance program and payments to those displaced by any Federally funded project and required replacement housing on a one-to-one basis. This act also extended the date of mandatory compliance by the States and one hundred percent Federal reimbursement for relocation costs to July 1, 1972. In 1971, the Indiana legislature amended the Indiana Relocation Assistance Act of 1967 to reflect the extension of Federal participation in relocation payments and the additional requirements of the Uniform Relocation Assistance and Real Property Acquisition Policies Act of 1970.

General Relocation Policies and Procedures. The general policy of relocation assistance, as set forth by State and Federal legislation, requires that no project causing the





displacement of person, business or farm operation will be approved unless fair and reasonable relocation payments, relocation assistance advisory services, and adequate relocation housing are provided for those displaced persons.

Relocation assistance advisory services were to be offered to "all persons occupying property to be acquired" and "all persons occupying property immediately adjacent to the real property acquired when the State determines that such person or persons are caused substantial economic injury because of the acquisition".<sup>110</sup>

On April 30, 1971, persons who moved from their residence because their property, used for a business or farm operation, was acquired were also to be provided relocation assistance advisory services. As set forth by Indiana and Federal laws, the relocation assistance advisory program was to consist of measures, facilities or services in order to-

"(1) determine the need, if any, of displaced persons, for relocation assistance;

(2) provide current and continuing information on the availability, prices, and rentals, of comparable decent, safe, and sanitary sales and rental housing, and of comparable commercial properties and locations for displaced persons;

(3) assure that, within a reasonable period of time, prior to displacement these will be available in areas not generally less desirable in regard to public utilities and public and commercial facilities and at rents or prices within the financial means of families and individuals displaced, decent, safe, and sanitary dwellings, as defined by such Federal agency head, equal in number to the number of and available to such displaced persons who require such dwellings and reasonably accessible to their places of employment, except that the head of that Federal agency (except that the Governor) may prescribe by regulation situations when such assurances may be waived;

(4) assist a displaced person displaced from his business or farm operation in obtaining and becoming established in a suitable replacement location;





(5) supply information concerning Federal and State housing programs, disaster loan programs, and other Federal or State programs offering assistance to displaced persons; and

(6) provide other advisory services to displaced persons in order to minimize hardships to such persons in adjusting to relocation".<sup>111</sup>

Provisions (2) and (6) were added after the Federal Aid Highway Act of 1968.

The State highway department was required to provide assurances of an adequate relocation assistance program. The State highway department would not be authorized to proceed with any phase of any federally funded project which would displace any person, even if the right-of-way is purchased with other than Federal funds, unless the State highway departments provided assurances on a statewide basis that relocation payments and services would be provided, the public would be informed of the relocation payments and services available and no person would be displaced without at least ninety days notice. Furthermore, the State highway department would not be authorized to proceed with right-of-way negotiations on any federally funded project which will dislocate any person unless it provided assurances on a project basis that comparable replacement dwellings will be available or provided for each person displaced within a reasonable period of time prior to displacement as set forth in a specific relocation plan to resolve any relocation problems and that "the State's relocation program is realistic and is adequate to provide orderly, timely and efficient relocation of displaced individuals and families to decent, safe, and sanitary housing with minimum hardship on those affected".<sup>112</sup>

Prior to each corridor public hearing, a project survey was made to develop a preliminary relocation plan (a relocation program plan at the conceptual stage). The survey determined the estimated number of individuals, families,



businesses, farms, and nonprofit organizations that would be displaced by each route alternative under consideration and the availability of decent, safe and sanitary housing within the financial means of the displaced, assuming that the relocatee will not downgrade his housing. An analysis of the survey was made to determine the availability of suitable replacement housing, any special problems of minority groups, low-income families, large families, handicapped or elderly, and a possible solution to these problems.

In accordance with Federal memoranda on relocation assistance, the Indiana State Highway Commission has prepared a brochure describing the relocation program in general, relocation assistance advisory services and relocation payments. The brochure was distributed at corridor public hearings, design hearings, at the time of "Notice of Intent to Acquire", and at the first relocation contact with the relocatees.

At the corridor public hearing, the discussion included at least the following:

"(1) the availability of relocation assistance and services, eligibility requirements and payment procedures;

(2) the estimated number of individuals, families, businesses, farm or nonprofit organizations that are to be relocated by each of the alternatives under consideration at the hearing; and

(3) the studies that have been or will be made and the methods that will be followed to assure that housing needs of the relocatees will be met."113

These specific guidelines on discussion in corridor public hearings were established on April 30, 1971. The ISHC required a state relocation official to be present at the hearing.

Prior to the design hearing, a direct contact survey was made to determine the characteristics and needs of the relocatees. The survey was conducted on a sample basis only, was to determine the necessity of providing relocation information at the design hearing, and would provide data for the relocation





plan. Indiana also required a State relocation official to attend the design public hearing. Since April 30, 1971, the discussion of relocation assistance at the design public hearing covered eligibility requirements and payment procedures, the relocation assistance advisory services available, the estimated numbers of people to be relocated, the estimated number of replacement dwellings available, the estimate of the time necessary for relocation, and the number of replacement dwellings that would be available during that period.

Prior to Federal approval to proceed with right-of-way negotiations, the State had to complete the relocation plan as assurance of an adequate relocation assistance program for the project. The project relocation plan included an inventory of individual needs, an inventory of available housing and an analysis of the inventories.

The inventory of the characteristics and needs of those displaced was based on the standards of comparable replacement housing, standards for the relocatee's ability to pay, and standards on the location of the replacement dwelling. Indiana utilized a direct survey rather than census information to obtain the information. The inventory of available housing was based on estimates of currently available comparable replacement housing. The estimates set forth the "type of buildings, state of repair, number of rooms, adequacy of such housing as related to the needs of the persons or families to be relocated, type of neighborhood, proximity of public transportation and commercial shopping areas, and distance to any pertinent social institution, such as church, community facilities, etc."<sup>114</sup>

In documenting the replacement housing estimates, the Indiana State Highway Commission described the basis of the estimates, indentifying the sources of data; established conclusions from the analysis of the data; described the nature and volume of competing demands for standard housing



because they would affect the ability of the Indiana State Highway Commission to carry out relocation for the highway project; described the special problems of minority groups and disadvantaged groups; estimated the displacements by ethnic group; described the financing available to displaced families; described the local housing program to assure the availability of new housing when new construction was required to meet rehousing needs; and included a letter from the local housing authority (concerning new and existing public housing) in the project relocation plan report.<sup>115</sup>

An analysis and correlation of the inventory of individual needs and available housing was necessary to develop a relocation plan that would:

- "(a) outline the various relocation problems;
- (b) provide an analysis of current and future Federal, State and community programs currently in operation in the project areas, and nearby areas affecting the supply and demand for housing from detailed information on concurrent displacement and relocation by other governmental agencies or private concerns;
- (c) provide an analysis of the problems involved and the method of operation to resolve such problems and relocate the relocatees in order to provide maximum assistance; and
- (d) estimate the amount of leadtime required and demonstrate its adequacy to carry out a timely, orderly and humane relocation program".<sup>116</sup>

Indiana utilized the "Notice of Intent to Acquire" only in hardship cases or protective buying situations to establish eligibility for relocation benefits prior to the initiation of acquisition of the parcel. The "Notice of Intent to Acquire" contained information on eligibility requirements, the anticipated date of negotiations, and where additional information on relocation assistance payments and services could be obtained.

Prior to the initiation of acquisition, Indiana contacted all owners to obtain information to compute the replacement housing payment and to explain the relocation assistance services available. When the negotiator called on the owner,





the owner was provided the fair market value offer for the property and the maximum amount of replacement housing payment to which he was entitled. Within fifteen days of the call on the owner, the tenants were informed of relocation assistance services available and the rental replacement housing payment to which they were entitled.

Fifteen days after the initiation of negotiations on the project, the Indiana State Highway Commission provided public announcements on relocation payments and services by various mass media. The announcement included the date the negotiations began, a description of the project area, information on eligibility requirements, advice that those moving should notify the State to insure eligibility for moving and replacement housing payments, advice to the owner that he must sell to be eligible for relocation benefits, and where the State's relocation brochure could be obtained.

After the negotiations were initiated, the State contacted all owners and tenants to deliver the "90-Day Notice to Vacate" and to compute the moving cost entitlements. Subsequent calls were made to complete payment forms, to render advisory assistance, and to assist in obtaining proper replacement housing.

Prior to the establishment of a separate Relocation Section in the Indiana State Highway Commission or the establishment of relocation agents, the negotiator delivered the "90-Day Notice to Vacate", advised the relocatee of the relocation payments and services available, and computed the relocation payments.

After the move had taken place, the relocation payments were delivered. In hardships cases, Indiana delivered the moving expense payment prior to the move. Prior to the delivery of the replacement housing payment, the dwelling was inspected to insure that it met the requirements of a decent, safe and sanitary dwelling.





Since June 24, 1970, the Division Engineer of the Federal Highway Administration would not authorize the advertising of bids for project construction unless adequate replacement housing existed and had been made available to the relocatees.

Evolution of the Relocation Process. Between 1962 and 1967, the relocation operation was strictly advisory because Indiana lacked the enabling legislation even to make moving expense payments that were eligible for Federal participation. Because of public pressure in Marion County, where over five thousand families were displaced in 1965 and 1966, the Indiana Legislature passed the Indiana Relocation Act of 1967 which contained an emergency clause that made it effective in March of 1967. This statute provided the first payments for moving costs and replacement housing in Indiana. Federal legislation authorizing Federal funds for dislocation costs and supplement housing costs (the difference between what the relocatee received for the property and what adequate replacement housing was selling for in given areas) did not come until a year later.

The Indiana State Highway Commission created the Relocation Section within the Division of Land Acquisition in 1969. Prior to that time, the relocation function was a part of the Buying Section (negotiating section) and the relocation service was provided by the negotiator.

Prior to 1967, there was no requirement that replacement housing be found before the individual was displaced. According to the Indiana Relocation Act in 1967, the agency causing the dislocation was to search for replacement housing and to convey the information to those to be displaced prior to the dislocation. With the passage of the Uniform Relocation Assistance and Real Property Policies Act of 1970, the State was required to supply replacement housing on a one-to-one basis prior to approval of right-of-way negotiations by the Federal government. Prior to the



act, the State had only to assure that adequate replacement housing was available on a group basis; for example, if forty houses were to be eliminated by the project, it was sufficient to show that at least thirty-five to forty vacancies existed in the community. Currently, the State must show that adequate, comparable, decent, safe and sanitary housing exists for each individual or family displaced.

The changes in the relocation process and the passage of the relocation acts were a direct result of public demands for meaningful relocation assistance. Most of the Indiana rural Interstate right-of-way and some right-of-way for the Indianapolis Interstates, where considerable dislocation occurred, were purchased prior to the Federal relocation requirements of 1968. Only the latter part of the Interstate Program in Indiana has been affected by the Federal relocation regulations. Nevertheless, the effects of relocation advisory assistance and payments first appeared on Interstate projects as the Interstate Program was the predominant program at that time. As a result of relocation assistance, right-of-way acquisition is more palatable to the relocatees, and most of the people who were displaced have bettered their standard of living.

Compensation for Losses. Since March of 1967, Indiana has been able to provide relocation compensation for losses. Because Indiana has had the necessary enabling legislation to comply with Federal requirements, it has been able to provide the full entitlements under the relocation provisions of the Federal Aid Highway Act of 1968 and the Uniform Relocation Assistance and Real Property Acquisition Policies of 1970.

Public projects cause losses to the public due to direct displacement, due to uncertainty and delay, and due to adverse affects on the surrounding areas; however, compensation is provided by law only for tangible and quantifiable losses, generally those due to direct displacement.





Losses Due to Direct Displacement. The provisions of the Indiana Relocation Act have been effective since March of 1967. The Federal Highway Administration only participated in the moving expense payments at that time. The relocation provisions of the Federal Aid Highway Act of 1968 (which was approved on August 23, 1968) were applicable to all Federal aid highway projects authorized after August 23, 1968 causing displacement and to all Federal aid highway projects authorized on or before August 23, 1968 which had not yet caused displacement, whether or not the right-of-way was acquired with Federal participation. Consequently, any project agreement executed on or before August 23, 1968 could be amended to provide for the costs of relocation and services if the property had not yet been acquired. The provisions of the Uniform Relocation Assistance and Real Property Acquisition Policies Act of 1970 were effective as of January 2, 1971. The Federal government paid one hundred percent of the cost of relocation payments and services up to \$25,000 for each case until July 1, 1972. After July 1, 1972, when all States were to be in full compliance with the Federal regulations, the Federal share of relocation cost was the same as the Federal share of the construction cost.

Under the Federal and State statutes concerning eminent domain, compensation is to be given for land and improvements thereon acquired for public use.

No compensation is given for the disruption of relationships because of its intangible nature.

Most losses on home financing are compensable. Incidental expenses such as recording fees, transfer taxes and other expenses incidental to conveying the real property are borne by the State in the acquisition of the property. Under the Indiana Relocation Acts of 1967 and 1971, the owner was compensated for prepayment penalties on mortgages. Under the Federal Acts, the prepayment penalty is covered by the interest differential payment. The Indiana Relocation Acts



provide for reimbursement of a prorated portion of the real property taxes; however, if a property is conveyed to the State prior to December 31st of any given year, the owner pays no property taxes for that year because State statute requires the auditor to remove the property from tax records. Although the person buying on contract is not necessarily reimbursed for the full contractual amount, he receives the same relocation benefits as if he had a mortgage on the property. In such cases, the relocation benefits to the contractual buyer may be greater than the mortgage.

The home owner is not compensated for the cost of seeking another home because the relocation agency provides this service. The relocation agent actually shows the relocatee possible dwellings, and places the relocatee in contact with the broker. The ISHC Relocation Section is very accommodating in regard to time in providing the housing location service to home owners; the housing search is at the convenience of the relocatee.

The relocation agency cannot provide the new location search for businesses because of the intricate requirements of individual businesses and the need for specialized knowledge in making new location selections for businesses. The State Relocation Act of 1971 and the Uniform Relocation Assistance and Real Property Acquisition Policies Act of 1970 reimburse the owner of a displaced business, farm or nonprofit organization up to \$500 for the actual reasonable expenses in searching for a replacement business, farm or building. Prior to these Acts, the cost was limited only by the maximum relocation payment in the Indiana Relocation Act of 1967. The Federal Aid Highway Act of 1968 had no provision for the cost of searching for a new business or farm site.

In lieu of moving costs allowances, the displaced business or farm is eligible to receive an amount equal to the average annual net earnings except that such payments could





not be less than \$2500 nor more than \$10,000 for Federal aid projects and not more than \$5000 for State projects. For a business to be eligible for such payment, the relocation agency must determine that the business "(1) cannot be relocated without a substantial loss of its existing patronage and (2) is not a part of a commercial enterprise having at least one other establishment not being acquired by the agency and which is engaged in the same or similar business".<sup>117</sup> In the case of a farm, the relocation agency must determine that the present operation has been dislocated or relocated to be eligible for the operational payment. If only part of the farm has been acquired, the remainder of the farm must be an uneconomic unit before the owner is eligible for the operational payment.

To be eligible for a replacement housing payment, a relocatee must occupy a decent, safe, and sanitary dwelling within one year. The displaced may either relocate to the same status (owner or tenant) or change status. However, legislation encourages the tenant to become a home owner and discourages the owner from renting. Nevertheless discouragement of renting was not the purpose in setting the maximum payments. The overall purpose of replacement housing payments was to upgrade the standard of living, encouraging the renter to become a home owner. The renter receives payment on a socio-economic basis; whereas, the home owner receives the difference between what he was paid for the acquired dwelling and the market cost of comparable housing. In most cases, both the home owner and the renter are bettered.

Under the Indiana Relocation Act of 1967, a displaced tenant was paid rental assistant for the excess of the fair, monthly rental value over twenty percent of his gross monthly income for two years without any maximum payment restriction, provided no adequate replacement dwelling is available and no public housing is available.<sup>118</sup> The Indiana Relocation





Act of 1967 had provisions for low cost loans up to \$2500 for owners for replacement housing; however, no loans were ever requested. Incidental costs of up to \$300 incurred in the purchase of replacement housing by a displaced tenant or owner were authorized by the Indiana Relocation Act of 1967.

Under the Indiana Relocation Act of 1971, a maximum of \$2500 is allowed for rental supplement or a down payment on a replacement dwelling. Under the Uniform Relocation Assistance Act of 1970, the owner of at least 180 days is eligible to receive up to \$15,000 (\$5000 prior to January 2, 1971) for replacement housing. The replacement payment includes the cost of comparable housing above the amount the State paid for the acquired dwelling, an amount to compensate the owner for the loss of favorable financing based on the interest rate differential of the mortgages, and an amount to reimburse the owner for expenses incurred incidental to the purchase of the replacement dwelling. The owner or tenant of at least 90 days is eligible to receive up to \$4000 (\$1500 prior to January 2, 1971) for a downpayment replacement housing; the relocatee is required to match any amount over \$2000 in making the downpayment. The owner of at least 180 days or tenant of at least 90 days who decides to rent receives up to \$4000 (\$1500 prior to January 2, 1972) for rent of a replacement dwelling; the payment is based on the difference between the rent of the replacement dwelling and the economic rent of the acquired dwelling over a four year period (two-year period prior to January 2, 1971).

The definition of comparable replacement housing or better is used in the determination of payments. The betterment came when the existing dwelling lacked sufficient bedroom or floor space or was deficient in some other housing standard. Actual assistance in finding places to live in based on the definition of adequate replacement housing. The definition of adequate replacement housing is also used in developing the relocation plan.

The first part of the paper discusses the importance of the study and the objectives of the research. It also mentions the scope of the study and the limitations. The second part of the paper discusses the methodology used in the study. It mentions the data sources and the statistical methods used. The third part of the paper discusses the results of the study. It mentions the findings and the conclusions. The fourth part of the paper discusses the implications of the study. It mentions the policy implications and the future research. The fifth part of the paper discusses the conclusion of the study. It mentions the overall findings and the recommendations.

The term comparable replacement housing means a dwelling that is (1) "decent, safe and sanitary as defined" by local building, plumbing, electrical, housing and occupancy codes; (2) "functionally equivalent and substantially the same as the acquired dwelling with respect to the number of rooms, area of living space, type of construction, age and state of repair"; (3) "open to all regardless of race, color, religion, sex or national origin", (4) in an area not generally less desirable than the acquired dwelling with respect to public and commercial facilities and public utilities; (5) "reasonable accessible to the relocatee's place of employment; (6) adequate to accommodate the relocatee; (7) in an equal or better neighborhood; (8) available on the market to the displaced person; (9) and within the financial means of the displaced family or individual".<sup>119</sup>

The definition of adequate replacement housing lacks elements (2), (7), and (8).<sup>120</sup> However, in practice the difference between comparable and adequate replacement housing is that adequate replacement housing need not be "functionally equivalent or substantially the same". As an example, for a couple without children living in a three bedroom house that is acquired, a one bedroom house is adequate replacement housing; however, replacement housing payment is based on a three bedroom house which is comparable replacement housing. The definition in the Indiana Relocation Act does not make a clear cut definition between comparable and adequate replacement housing and defines "reasonably accessible" as within ten miles of the place of employment.

In compliance with Federal regulations, Indiana compensates sign owners for the cost of moving a sign, direct loss of tangible property when the sign is not moved, and the cost of searching for a new sign site not to exceed \$100. For Federal aid highway projects such compensation has been paid since the Federal Aid Highway Act of 1968. Under Indiana





relocation law, signs are treated as if they were businesses, Indiana is more lenient in that it will pay up to \$500 in searching for a replacement site. With special approval, the Federal government will also pay up to \$500.

Junkyards are considered businesses under Federal and State law.

Mobile home owners are treated the same as other home owners in regard to compensation. The mobile home owner is given the option of replacement dwelling payments because zoning regulations may prohibit mobile homes in the area such that the relocatee must go to a conventional home to stay in the area or because the existing mobile home may not meet the definition of decent, safe and sanitary housing.

A displaced person, business, farm operation or nonprofit organization is entitled to receive a payment for actual and reasonable expenses in moving up to fifty miles (twenty-five miles for Indiana Relocation Act of 1967). In lieu of such payment, the person may elect to receive a moving allowance based on a schedule not to exceed \$300 (\$200 prior to January 2, 1971) and a dislocation allowance of \$200 (\$100 prior to January 2, 1971). It is advantageous in most cases to use the schedule rather than the actual cost to move because the schedule was created with more flexibility. In lieu of the payment for actual moving expenses, the business or farm operation may select the operational payment. The nonprofit organization, having no income; has no option other than payment for actual moving expenses.

Losses Due to Uncertainty or Delay. Social and economic losses due to uncertainty or delay of the project are not compensable. No compensation is given for deteriorating neighborhood life because the deterioration may not be directly attributable to the project proposed. Owners are not compensated for the inability to sell their property or to obtain an improvement loan because of the proposed location of a project. The owner is not compensated for any interim decline



in property value between the time the location of the highway is approved by the Federal Highway Administration and the date the fair market value is established. The loss of rental income due to an impending project is not compensable under State or Federal law. The cost of maintaining the property after the appraisal is not compensable even in the case of unusual maintenance.

**Indirect Losses in Surrounding Areas.** No indirect losses to the surrounding area caused by the project are compensable under State or Federal Statute. Such losses might include higher taxes; disruption of traffic; reduction in the quantity and quality of local services if the project removes some of the facilities that once served the surrounding neighborhood; a reduction in employment opportunities or increased commuting costs; spillover impact outside the clearance area causing depressed land values and deterioration to spread to other areas; reduced operating efficiency of community facilities because of reduced patronage; and decreased relative accessibility within the neighborhood. Advisory services, but no payments, are offered to persons occupying property adjacent to the property acquired if they suffer substantial economic injury.

The requirement that adequate replacement housing must exist or be built by the State prior to the demolition of existing housing generally prevents increased competition for low-cost housing because of a reduction in housing supply. The Indiana State Highway Commission does not have the power to construct replacement housing if such is required for the approval of a project. Consequently, the project would not be scheduled for right-of-way acquisition until adequate replacement housing became available. The environmental guidelines are designed to prevent or minimize many of the possible adverse environmental changes in the surrounding areas due to a proposed project.





Cooperation with Other Agencies. The Indiana State Highway Commission has not delegated its relocation duties to a local agency because the funds were always administered through the State in the case of Federal aid or State highway projects, not directly by local agencies; it was inefficient to permit the local agencies to administer programs; the coordination of local agencies was considered ineffective; and the local agencies often lacked the knowledge and experienced personnel necessary to administer such programs. The Indiana State Highway Commission did have contracts with local agencies in Indianapolis to provide relocation advisory and referral services. In all highway projects causing substantial displacement, the Indiana State Highway Commission established field offices readily accessible to those affected.

#### Utilities Relocation

Since the Interstate System was a new highway system that would be superimposed on the existing highway network, Congress felt there would be considerable utility displacement due to the size of the Program. Consequently, the Federal Aid Highway Act of 1956 authorized the reimbursement of States for the cost of utility relocation in the same proportion as Federal funds expended on Federal aid projects, provided no State law or legal contract between the State and a utility company was violated. The cost of relocation was the amount paid the utility company after any increase in value of the new facility and any salvage value derived from the old facility was deducted. The Federal Aid Highway Act of 1958 added the requirement that reimbursement would only be made after evidence was presented to the Federal government substantiating the fact that the State paid the relocation costs out of its own funds on Federal aid projects for which funds were obligated after April 14, 1958.





Indiana has always reimbursed utilities for the relocation of facilities necessitated by highway construction when the utilities were on private easement or right-of-way. When the utilities occupy public right-of-way, the utility companies have to bear the full cost of relocation caused by highway construction because the utility company acquires no vested interest in the highway right-of-way necessitating compensation.

In Indiana, the utilities occupy public right-of-way as a legal "qualified right" not as a privilege, but they do not acquire a vested interest in the public right-of-way that can be compensated. Due to the fact that the relocation cost would be born by the utility rate payers and that Federal funds were available for a substantial part of the relocation cost, the Indiana legislature felt that the relocation of utilities, as a result of Interstate construction, should receive special treatment. In effect, the Indiana Utility Relocation Act of 1961 ignored the utility company's prior interest in the right-of-way and reimbursed the utility company for the cost of relocation of facilities necessitated by the construction of the Interstate System when the utilities were on public or private right-of-way. The Federal regulations also ignored the utility company's prior interest in the right-of-way and authorized reimbursement.

Utility Relocation Procedures. The first intimation of possible utility relocation is based on a review of projects scheduled for planning and design. At the time of the design field inspections, a review is made of the design plans to insure that all of the utilities are properly shown and that the ownership is correctly identified. After the design study is completed, the right-of-way plans are forwarded to the Division of Land Acquisition and the Utility Relocation Section.



Until 1959, the utility relocation function was initially performed by the Division of Land Acquisition because utility relocation cost reimbursement was in lieu of the process of eminent domain. The Utility Relocation Section forwards a set of design plans to the utility companies involved and a letter asking the company if the utility is correctly shown and if reimbursement will be requested for relocation. If the utility company requested reimbursement, they were asked to forward their plans, specifications and estimates by a specific date. The due date varies from one year, for complex projects, to a minimum of three months before the highway construction is let. Recently, utility companies have been asked to return their proposed relocation plans even though they were not requesting reimbursement.

The utility relocation plans are checked by the Indiana State Highway Commission to insure compatibility with the highway construction plans and are approved by the Federal Highway Administration. When the utility relocation plans have been approved, the Indiana State Highway Commission authorizes the utility company to proceed with the relocation. Indiana attempts to have the utility relocation completed at least a month before the highway construction letting to prevent conflict between the utility and the contractor. In the more complex utility relocations, coordination may be provided between several utilities and the highway contractor. During the utility relocation, the progress is monitored. The utility company is reimbursed for its cost of relocation after an audit of records by the State.

These procedures have not changed significantly since the Interstate Program began. The only changes have been more auditing, greater study of preliminary relocation plans, a greater environmental consciousness in reviewing the relocation plans, and an unprecedented work load.





Utility Accommodation Policies. Indiana has had the power to regulate the use of highway right-of-way by utilities since the 1850's. As each utility came into being, Indiana passed statutes to regulate the utility's use of highway right-of-way. Although it was considered in the public interest to accommodate utility facilities on highway right-of-way, the use and occupancy of highway right-of-way by the utility must be controlled to preserve the integrity, scenic appearance, free and safe traffic operation and function of the highway. Consequently, in accordance with Federal requirements, Indiana has established utility accommodation policies and procedures.

Indiana's "utility accommodation policy" follows the AASHO policy almost word-for-word, but is more stringent in some instances. In the case of the Interstate System, the AASHO Policy on the Accommodation of Utilities on the National System of Interstate and Defense Highways is closely followed by the Indiana State Highway Commission.

In general, all utilities were forbidden to utilize Interstate right-of-way. Utilities may cross the Interstate laterally, but can only parallel the Interstate for limited distances. In the case of other limited access highways, utilities have been allowed to parallel the highway for no more than one thousand feet. A utility presently occupying the highway right-of-way would be able to occupy the right-of-way if the highway was rebuilt into a limited access highway. Indiana prohibits the occupation of new limited access right-of-way by a new utility except when other utility locations are economically infeasible. Although Indiana had few limited access highways prior to the Interstate, the policy on utility accommodation was finalized before the Interstate Program.

The Indiana State Highway Commission tightly regulates the location of new utility installations within scenic strips, overlooks, rest areas, recreational areas, the right-of-way of adjacent highways, and highway rights-of-way that pass

The first part of the paper discusses the importance of the study of the history of the United States. It is argued that a knowledge of the past is essential for a full understanding of the present. The author then goes on to discuss the various factors which have shaped the development of the United States, including the influence of the British, the Spanish, and the French. He also discusses the role of the American people in the creation of the nation, and the importance of the Constitution. The paper concludes by discussing the future of the United States, and the role of the American people in shaping that future.

The second part of the paper discusses the importance of the study of the history of the United States. It is argued that a knowledge of the past is essential for a full understanding of the present. The author then goes on to discuss the various factors which have shaped the development of the United States, including the influence of the British, the Spanish, and the French. He also discusses the role of the American people in the creation of the nation, and the importance of the Constitution. The paper concludes by discussing the future of the United States, and the role of the American people in shaping that future.

The third part of the paper discusses the importance of the study of the history of the United States. It is argued that a knowledge of the past is essential for a full understanding of the present. The author then goes on to discuss the various factors which have shaped the development of the United States, including the influence of the British, the Spanish, and the French. He also discusses the role of the American people in the creation of the nation, and the importance of the Constitution. The paper concludes by discussing the future of the United States, and the role of the American people in shaping that future.

The fourth part of the paper discusses the importance of the study of the history of the United States. It is argued that a knowledge of the past is essential for a full understanding of the present. The author then goes on to discuss the various factors which have shaped the development of the United States, including the influence of the British, the Spanish, and the French. He also discusses the role of the American people in the creation of the nation, and the importance of the Constitution. The paper concludes by discussing the future of the United States, and the role of the American people in shaping that future.

The fifth part of the paper discusses the importance of the study of the history of the United States. It is argued that a knowledge of the past is essential for a full understanding of the present. The author then goes on to discuss the various factors which have shaped the development of the United States, including the influence of the British, the Spanish, and the French. He also discusses the role of the American people in the creation of the nation, and the importance of the Constitution. The paper concludes by discussing the future of the United States, and the role of the American people in shaping that future.

public parks, recreational areas, wildlife and waterfowl refuges and historic sites. In the case of the Interstate System, utility installations are prohibited in these areas except for service lines to facilities in the areas. A utility line would only be allowed through park areas along the Interstate System if there was no economically feasible alternative route for the utility. The control of utilities on highway right-of-way that parallel park lands is more flexible for the lower type highway systems.

When the utility must be relocated due to the acquisition of its right-of-way or the upgrading of a highway facility and cannot be relocated on the highway right-of-way as is true for the Interstate System, the Indiana State Highway Commission will reimburse the utility for replacement right-of-way which the utility purchases under its private power of eminent domain. The Indiana State Highway Commission is barred by statute from purchasing right-of-way with highway funds for other than a highway use. Payment for replacement right-of-way is only possible when the utility was dislocated from land in which it has a vested interest (private right-of-way). In the case of the Interstate System, however, the utility would be reimbursed for replacement right-of-way regardless of the utility's interest in the prior location.

On the Interstate System, a utility is required to encase liquid carrying pipes from right-of-way line to right-of-way line because of the possibility of rapid fill erosion should a pipe fail. Encasement is considered on a project basis on other systems. Federal and State governments will participate in the additional costs incurred by the utility if the costs are attributable to a planned highway project. Because all future utilities crossing the Interstate right-of-way would have to be bored under the highway and encased at considerable expense, the far-sighted utility companies placed encasements for future pipelines crossing right-of-way of the proposed





Interstate highway at their own expense. However, if the utility was a relocation caused by the Interstate project, the Indiana State Highway Commission might reimburse the company for an additional easement, or larger duct or easement for future lines.

### Specifications, Contracts and Bidding

After the design study and design hearing have been approved by the Federal Highway Administration, the designs are completed and cost estimates are made. Then the design details and pay items are checked for compliance with the Indiana construction specifications. If design plans are in accordance with the specifications, the only special provision added is maintenance of traffic during construction. However, if there are special details or designs associated with the project and if the pay item is not covered by the specifications, a specification must be written for the particular item, termed a special provision. If the same item appears as a special provision consistently for two years, the item is made a supplement to the construction specifications so that the special provision will not have to be written up for every project.

Before the construction bid letting, the final plans, specifications and estimates are submitted to the Federal Highway Administration for approval. Since the submission includes the amount of Federal and State financing of the project, the Federal Highway Administration allocates its share when it approves the project. In this manner, a project agreement is reached between the Federal Highway Administration and State.

Once the project agreement has been concluded between the Federal and State government, the contract forms are prepared. The "Legal Notice of Letting" is generally published twice in two newspapers in the county of the project





twenty-one days prior to the letting for Federal aid projects or ten days prior to the letting for State projects. Advertisements of the letting are also placed in contractor publications. The "Legal Notice of Letting" contains information on the type of construction, district to supervise the work, location of work, net length of contract, the project number, and the highway number; states that bids will be received on a certain day, at a certain time, and at a certain place; informs the contractor of nondiscrimination requirements; and tells where the plans and contract proposals may be obtained.

A list of prospective bidders is maintained of those to be sent a "Detailed Notice of Letting". The "Detailed Notice of Letting" contains the same information as the "Legal Notice of Letting" plus information such as the percent of paving, grading and drainage on the job, the pavement width; the costs of proposals, plans and cross section sheets; and the qualification requirements for contractors and subcontractors.

At the given time, the bids are opened in public and read aloud. If one bid is below the secret cost estimate of construction of the Indiana State Highway Commission, the secret estimate is read aloud. If there are no bids below the secret estimate, it is not disclosed; and an announcement is made that no bids were received below the engineer's estimate. Although the State can award the contract if the low bid was within five percent of the engineer's estimate, Indiana prefers to readvertise the contract for another bidding.

Once the bids are received, the Indiana State Highway Commission meets in full session and awards the contract to the low bidder. The contractor's documents are forwarded to the Federal Highway Administration for concurrence in the award of contract. At this point, the project



agreement between the Federal government and State may be executed.

Specifications. The specifications set forth the standards of construction that the contractor must follow. The Indiana specifications on general requirements are based on the AASHO Specifications for General Provisions. The only major changes in the specifications have been due to the environmental emphasis. As a result, tighter specifications have been written to prevent erosion and water pollution and to control burning on the construction site.

The contractor must obtain approval to operate temporary borrow pits. After the excavation is completed, the contractor is required to cut back the slopes to blend in with the existing ground level and to plant grass in the area. Prior to approximately 1968, the contractor was given more freedom to operate the borrow pit and he often left unsightly scars on the land.

On the construction site, the contractor is only permitted to expose a portion of the project to erosion and must reseed the project as construction progresses. The contractor is encouraged to take measures to reduce erosion and is usually required to build the erosion controlling features of the highway first.

Currently, the contractor cannot dispose of excess materials or cleared trees without a variance, except by burial. On request, the Air Pollution Control Board of the county issues a variance which controls the volume and method of burning. In some counties, where burning is prohibited, the contractor must bury or haul the surplus material away and burn it. Indiana has added a special provision on an experimental basis that will pay the contractor to have the surplus material hauled off the site. Inspection is now more stringent to insure that the contractor cleans up the construction site.





Contract Proposal. The contract proposal consists of the notice to contractors, the special provisions, the required Federal provisions, the proposal, the bid schedule, the bid guarantee, the contract and the contract bond. The elements of the contract have not changed since the Interstate Program began; however, the content of some of the elements of the contract have changed during the Interstate Program.

Notice to Contractors. The "notice to contractors" of the Indiana State Highway Commission consists of special information and instructions to bidders. The special information includes general information on filling out the proposal, including where the contractor must sign; instructions on completing the plan of construction and the equipment questionnaire; prequalification requirements; borrow pit arrangements; the availability of soil investigation reports; and requirements in regard to cooperation with the county, labor standards, safety standards and construction signing. The instructions to bidders describe options in the selection of materials used in construction.

Special Provisions. The special provisions include specifications for design details not covered in the general specifications. Special controls concerning erosion control, burning, and traffic maintenance are generally included. The special provision for the maintenance of traffic states that the highway must be kept open at all times except under specific circumstances, and suggests a method and schedule of construction operations to maintain traffic flow. An alternate plan suggested by the contractor requires State approval because the contractor is reimbursed for the cost of maintaining traffic. Because of disruption of local traffic circulation by the Interstate construction, the Indiana State Highway Commission has given increased emphasis to the importance of maintaining local traffic



circulation during construction. Indiana now builds considerably more runarounds to maintain traffic flow during construction on all systems.

**Federal Provisions.** The required contract provisions for Federal aid projects encompass nondiscrimination; payment of predetermined minimum wages; statements and payrolls; a record of materials, supplies and labor; subletting or assigning the contract; safety and accident prevention; and false statements concerning highway projects. Only the provisions on nondiscrimination, minimum wage and safety have changed significantly during the Interstate Program.

The Civil Rights Act of 1964 brought about the addition of the nondiscrimination provision to all Federal aid project contracts in February of 1965. The nondiscrimination provision covered primarily employment practices. The Federal Aid Highway Act of 1968 required assurance that equal employment opportunities were provided in all federally funded highway projects. Consequently, the nondiscrimination provision was replaced by an equal opportunity provision and a nonsegregated facilities provision. The equal opportunity provision covered the selection of labor, employment practices, the selection of subcontractors, the procurement of materials, and the leasing of equipment.

Originally the contractor was allowed to submit a plan in regard to equal employment opportunities. Since March 17, 1969, the Specific Equal Employment Opportunity Responsibilities special provision required the contractor to submit specific information. This special provision covered equal employment opportunity policy, the designation of an Equal Employment Opportunity Officer by the contractor, the dissemination of policy, recruitment, personnel actions, training and promotions, unions, subcontracting, and records and reports to support compliance. Since September 2, 1970, the training special provision has been further expanded.





In addition to the Specific Equal Employment Opportunity Responsibilities special provision, there are home town plans for Marion and Vanderburg Counties. The Indianapolis (Marion County) Plan is modeled after the Philadelphia and Detroit Plans. Such home town plans establish a minority group quota for each of the trades that the contractor must meet. The contractor who signs a contract under the Indianapolis Plan is required to follow the plan for three years after the completion of the initial Federal aid project even though the contractor may not work on another Federal aid project during the three-year period.

The Federal Aid Highway Act of 1956 extended the prevailing rate of wage, as set forth by the Davis-Bacon Act of 1935, to all Interstate construction. The provision required contractors to pay a minimum wage for each class of worker for Interstate construction comparable to the wage rate for similar work in the immediate locality. The prevailing wage rate requirement was extended to all federally funded projects by the Federal Aid Highway Act of 1968. The minimum wage provision has been required for highway projects constructed with State funds since 1932.

The Occupational Health and Safety Acts of 1971 established detailed safety and accident guidelines for all industries. The Acts required the contractor to designate a Safety Officer to insure the standards are met. Compliance with these safety standards is required by the Federal safety and accident prevention provision.

Indiana has similarly required contract provisions for State funded projects. As a general rule, the contract provisions required for State funded projects are not as stringent as those required for Federal aid projects.

Proposal. The proposal includes a legal description of the project, the project length, the contract and project number, the time the contractor has to complete the contract,





and a place for the signature of the contractor. The proposal also states that the proposal and contract bond shall not be less than one and one-half times the amount of the proposal.

**Bid Schedule.** The bid schedule (itemized proposal) lists each bid item, the quantity, the unit involved, a place for the contractor to fill in his unit price, a place for the extension of the unit price (the quantity times the unit price), and a place for the grand total which is the sum of all the extensions. When the bids are received, all bids are checked by the computer, and the contract award is made on the basis of the corrected bid, if necessary.

The contractor is paid on the basis of the final estimate of the work done after construction is completed. If the final quantity differs from quantity in the itemized proposal, the project engineer fills out a "change of plans order" which reflects the difference. When additional construction work is not covered by a unit price in the proposal, an "extra work agreement" is made with the contractor to establish the unit price.

**Bid Guarantee.** The bid guarantee is the posted bid bond which amounts to five percent of the bid for construction and it is returned to all except the three lowest bidders as soon as the bids have been opened and checked. The intent of the bid bond is to protect the State from financial loss if the State has to award the project to the next lowest bidder or to relet the project. Such a problem has never occurred for an Interstate project. The contract for the construction becomes effective when the Executive Director of the Indiana State Highway Commission signs the contract two weeks to two months or more after the letting.



**Contract.** The highway contract includes the contract number and the signature of the contractor and the Executive Director of the Indiana State Highway Commission. The contract also states that the contractor will be paid on the basis of progress estimates, but the progress payments cannot exceed ninety-five percent of the estimates. The balance is paid the contractor when the final estimate of cost is determined. Liquidated damages are set forth in the Indiana specifications.

**Bond.** The proposal and contract bond amounts to one and one half times the bid price and is signed when the bid is submitted. The intent of the contract bond is to protect the State if the contractor defaults on the contract and the State must complete the work.

**Bidding.** Before a construction company can bid on a construction project, it must be prequalified to handle a certain amount of work and a certain type of work. Prequalification is intended to protect the State from contractors that overextend themselves, go bankrupt, or default on their contract. The contractor is prequalified to handle a certain work load based on experience and financial condition. The contractors are required to renew their prequalification annually.

When the contractor submits a bid on a project, he must complete a questionnaire on his current work load in monetary terms. The amount of the current work and the amount of the bid cannot exceed the contractor's prequalification amount. If the bidder exceeds the prequalified amount, his bid would be voided. The contractor is able to increase his prequalification by additional financial backing, provided the loan is not due until after the expiration date of the prequalification and does not come from an owner of the company. The amount of prequalification reflects the liabilities and assets of the company.





Indiana utilizes the conditional form of bidding. A contractor may make up to three regular bids and three conditional bids for each regular bid on different projects at any letting. The contractor, however, may only be awarded the number of contracts equal to the number of regular bids since the total value of the regular bids cannot exceed the limit of prequalification. If the contractor is not low bidder on a regular bid on one project but is low bidder on any conditional bids on other projects, he may replace his regular bid on one project by a conditional bid on another project. If the contractor proves to be low bidder on more than one conditional bid, the Indiana State Highway Commission selects the bid it prefers. Conditional bidding allows the small contractor to bid on more than one contract although his prequalification restricts him to the acceptance of only one contract; the large contractor to pick up a contract to fill out his work load; and more competitive bidding and more bidders.

The magnitude of the Interstate program resulted in larger contracts. Consequently, the prequalification limits of the contractors grew as they expanded their operations to bid for the larger contracts.

### Construction

Construction supervision by the Indiana State Highway Commission has changed insignificantly during the Interstate Program. However, the Interstate Program caused spectacular changes in construction technology.

Construction Policies and Procedures. During the Interstate Program, the primary role of the Division of Construction of the Indiana State Highway Commission was to insure that the contractor fulfilled his contract obligations. The progress and quality of work was of primary concern to the State.



Prior to the award of the contract, the contractor was required to file a construction plan that established a time schedule for each work item. As long as it appeared that the contractor would complete his job by the established date; the Indiana State Highway Commission did not question the contractor's time schedule. The Indiana State Highway Commission did not use a scheduling technique such as the critical path method in scheduling items within a contract and did not require the contractor to do so.

Field reports were filed monthly to maintain a monthly construction progress report on each project. If the contractor fell behind schedule, the Indiana State Highway Commission persuaded him to catch up. Most construction contracts required the project to be completed in a specific number of work days. If the weather prohibited work on a day, the contractor was not charged for the day. On an emergency or crash project, the construction contract required the project to be completed in a specific number of calendar days without consideration for weather. On the last link of several Indiana Interstate routes, the Indiana State Highway Commission required the contractor to complete the work in a specific number of calendar days. The liquidated damages for the failure to complete a project as required are established by the Indiana book of construction specifications. On no Interstate project was the contractor given a bonus for completing the construction ahead of schedule. On the other hand, fewer than five percent of the Interstate projects fell behind schedule resulting in liquidated damages.

The contractors were paid twice a month on the basis of semi-monthly progress estimates. The progress payments were limited to ninety-five percent of the progress estimate; the Indiana State Highway Commission retained five percent of the progress estimate through the entire life of the contract.





After the contract was completed and accepted, Indiana law permitted the Indiana State Highway Commission to reduce the percentage retained provided there were no claims or liquidated damages against the contractor. Since 1968, the Indiana State Highway Commission reduced the retainage from five to two percent. As the 1971 Indiana legislature required the Indiana State Highway Commission to pay interest on any payment retained after one hundred and eighty days, the Indiana State Highway Commission has taken steps to reduce the retained percentage below two percent.

In the inspection of the work site, increased attention has been given to the contractor's measures to reduce erosion and prevent water pollution as required by the construction specifications. When the contractor utilized private land for storage yards or batching plant facilities, the contractor was required to obtain a property release from the owner stating the property was left in satisfactory condition as specified in the original agreement. The contractor was required to submit plans for the use of borrow pits. These plans were evaluated by the State to insure pleasing back slopes, adequate drainage, proper blending into the surrounding area and final restoration.

Evolution of Construction Technology. The magnitude of the Interstate Program has resulted in increased mechanization and the accelerated development of new equipment and methods. The amount of earthwork on Interstate projects required larger and more mechanized equipment; this equipment allowed the contractor to move more earth per given amount of time without increasing labor costs. The CMI string line control automatic subgrader allowed the contractor to grade greater lengths at lower costs. Although slip-form paving was developed in Iowa in 1947, it was not utilized in Indiana until 1967. Because of the long lengths of Interstate projects, the contractors gradually went to slip-form





paving to reduce labor costs. Because of the increased number and size of bridges, the equipment industry developed bridge deck finishing machines to eliminate finishing work by hand. Since the Interstate Program was the predominant highway construction program for over fifteen years, the Interstate System was the catalyst and paving ground for innovations in construction technology too numerous to mention.

### Maintenance

Maintenance costs are related to the amount of traffic, the number of lanes, the type of area, the right-of-way width, and the climate. Because the Interstate System carries greater traffic loads and has wider right-of-way widths, the Interstate System will cost more to maintain than any other system on a mileage basis.

The Interstate System has affected maintenance practices and procedures primarily through the addition of increased mileage; the basic maintenance operation has not changed. Since the character of maintenance on the Interstate System differed little from maintenance on other State highways, Indiana has not created exclusive Interstate maintenance crews to give the Interstate System specialized treatment. Since the Interstate System is a young system, the amount of current personnel devoted to the Interstate System is minor compared to other systems with the exception of snow and ice removal and other service type operations which are approximately equal to other systems on a per mile basis. Most of the mowing on the Interstate and other dual-lane facilities is done by contract because of the size of the operation.

The Indiana State Highway Commission adopted the unit maintenance concept immediately prior to the Interstate Program. Indiana is divided into six districts, each with six subdistricts (except for the LaPorte District which has



seven), and each subdistrict with three to five units. The units are intended to be self-sufficient maintenance centers.

Since the unit concept was not initiated until the Interstate Program began, the maintenance units have been located near the Interstate routes to give the Interstate System equal or slightly greater priority than the other systems, to obtain better access to the Interstate System because access is limited, and to utilize the increased accessibility of the Interstate in the maintenance of other highways. This has generally allowed the same manpower and equipment to take care of additional Interstate and other mileage as added within a unit area. A few new facilities and expansion of present facilities, however, has been necessary to fully implement the unit maintenance concept, and expand and improve maintenance for the expanding highway network.

Indiana started to contract mowing when the Interstate and other dual highway mileage began to accumulate. Recently, mowing has been limited to the ditch line to reduce maintenance costs, to prevent erosion, to eliminate conflicts with plantings, and to allow a portion of the roadside to revert to its natural state.

The Interstate System will increasingly cost more to maintain than other systems because of the large area of right-of-way, pavement width which includes paved shoulders, and number and size of traffic control devices. The increased area of right-of-way has meant more mowing. The extensive landscaping and numerous safety rest parks along the Interstate have necessitated maintenance expenditures that are shared by few other systems. The number of lanes, the ramps of interchanges and the accompanying shoulders add to the increased cost of the Interstate System over others. The high speeds of the Interstate have required larger signs. Consequently, elaborate overhead and cantilever sign





structures have been built with accompanying maintenance requirements. The extensive use of pavement markings, shoulder edge delineators, guardrails, lighting, and other safety devices on the Interstate has also required greater maintenance expenditures.

### Interstate System Construction Priorities

The Interstate Program did not alter the traditional relationship between the Federal government and States in which the State highway departments initiated all projects. Consequently, each State established their own priorities in constructing segments of the Interstate System to reflect the highway needs in their State. In scheduling segments of the Interstate for construction, the Indiana State Highway Commission gave consideration to corridor deficiencies, congestion in urban areas, and geographic distribution. As a general objective in determining construction priorities, the Indiana State Highway Commission wanted to complete as many miles of the Interstate System as rapidly as possible.

In recognition of corridor deficiencies, the Indiana State Highway Commission replaced two-lane paralleling highways first and delayed the replacement of dual-lane highways until last. This criterion reflected the general deficiencies in the existing highway network where the need for the Interstate was greatest and yielded the greatest benefit to the highway user. Consistent with this criterion, the first Interstate segments built were on Interstate 74 to replace obsolete two-lane U.S. 136 west of Indianapolis and obsolete two-lane U.S. 421 east of Indianapolis, and on Interstate 65 from the Ohio River to Taylorsville where U.S. 31 was dual-laned to Indianapolis and from Indianapolis to Lebanon where U.S. 52 and U.S. 41 provided a dual-lane route to the Chicago Metropolitan Area. Interstate 69 also was constructed in the earlier part of the Interstate Program



because it replaced deficient two-lane routes. The construction of Interstate routes that were paralleled by existing dual-lane routes included the remainder of Interstate 65, Interstate 70, and Interstate 94. Construction on Interstate 64, Interstate 265, and Interstate 275 was delayed until the latter part of the Interstate Program because there was little demand for these routes in comparison to the other Interstate routes.

In an attempt to alleviate congestion in urban areas, Interstate bypasses were generally built before the remainder of the route. The construction of portions of Interstate 465, of Interstate 69 around Ft. Wayne, and of Interstate 70 around Richmond and Terre Haute was consistent with such an objective. The construction of Interstate 70 and Interstate 74 from Indianapolis toward the rural areas also reflected the importance of relieving urban congestion. The early construction of Interstate 64 and Interstate 65 in the Louisville Metropolitan Area reflected the need to reduce urban congestion through additional crossings of the Ohio River. The need for adequate bridges across the Wabash resulted in the early construction of Interstate 74 near Covington and Interstate 64 near Griffin.

To the degree that the Interstate routes in Indiana ran through many counties of the State, construction of the Interstate routes was geographically distributed. However, highway needs were a far more important criterion in determining construction priorities.

To complete as much of the Interstate as rapidly as possible so as to benefit the most people, Indiana placed a higher construction priority on those segments of Interstate where terrain, the rapid acquisition of right-of-way, and the availability of plans assured rapid construction. Because of general planning requirements, the complexities of coordination and design, and complex acquisition of right-of-



way, the Interstate radials and inner belt of Indianapolis could not be constructed until the latter part of the Interstate Program, even though planning was begun at the beginning of the Program.

### Notes

1. Laws Relating to Federal Aid in Construction of Roads (Washington, D.C.: U.S. Government Printing Office, 1971), p. 146.
2. U.S. Department of Transportation, Federal Highway Administration, Instructional Memorandum 10-3-68 (Subject: Additional Interstate System mileage designations authorized in the Federal-Aid Highway Act of 1968) (Washington, D.C.: Federal Highway Administration; August 28, 1968), Enclosure C.
3. Laws, p. 432.
4. Instructional Memorandum 10-3-68, p. 1.
5. Instructional Memorandum 10-3-68, p. 2.
6. Instructional Memorandum 10-3-68, Enclosure C, p. 3.
7. Instructional Memorandum 10-3-68, Enclosure C, p. 3.
8. Instructional Memorandum 10-3-68, Enclosure C, p. 3.
9. Instructional Memorandum 10-3-68, Enclosure C, p. 3.
10. Instructional Memorandum 10-3-68, Enclosure C, p. 4.
11. Instructional Memorandum 10-3-68, Enclosure C, p. 4.
12. U.S. Department of Transportation, Federal Highway Administration, Policy and Procedure Memorandum 20-8 (Subject: Public Hearings and Location Approval) (Washington, D.C.: Federal Highway Administration; January 14, 1969).
13. U.S. Department of Commerce, Bureau of Public Roads, Circular Memorandum 9-15-64 (Subject: Location of Interstate and Other Federal-aid highways) (Washington D.C.: Bureau of Public Roads; September 15, 1964), p. 2.





14. Highway Users Federation For Safety and Mobility, Economic Analysis For Transportation - A Guide For Decision Makers (Washington, D.C.: Highway Users Federation For Safety and Mobility; March, 1971), p. 16.
15. Economic Analysis For Transportation, p. 16.
16. Policy and Procedure Memorandum 20-8, p. 1.
17. Policy and Procedure Memorandum 20-8.
18. U.S. Department of Transportation, Federal Highway Administration, Policy and Procedure Memorandum 90-1 (Subject: Guidelines for Implementing Section 102 (2)(C) of the National Environmental Policy Act of 1969, Section 1653 (f) of 49 U.S.C., Section 470f of 16 U.S.C., and Section 309 of the Clean Air Act of 1970).
19. Policy and Procedure Memorandum 20-8, p. 4.
20. Policy and Procedure Memorandum 20-8, p. 2.
21. Policy and Procedure Memorandum 20-8, p. 5
22. U.S. Bureau of Budget, Circular Memorandum A-95 (Revised) (Subject: Project Notification and Review System) (Washington, D.C.: Bureau of the Budget; February 9, 1971), p. B-21.
23. U.S. Department of Transportation, Federal Highway Administration, Instructional Memorandum 21-12-67 (Subject: Interim procedures for program review required by Section 204 of the Demonstration Cities and Metropolitan Development Act of 1966) (Washington D.C.: Federal Highway Administration; June 23, 1967). This instructional memorandum was superceded by the following: U.S. Department of Transportation, Federal Highway Administration, Instructional Memorandum 50-1-70 (Subject: Procedures for program evaluation, review, and coordination required by Section 204 of the Demonstration Cities and Metropolitan Development Act of 1966, and Title IV of the Intergovernmental Cooperation Act of 1968) (Washington, D.C.: Federal Highway Administration; January 12, 1970).
24. Circular A-95, p. B-23.
25. Circular A-95, p. A-1.
26. Instructional Memorandum 50-1-70, Exhibit 2.



27. Indiana Department of Commerce, Division of Planning, Intergovernmental Cooperation (Indianapolis, Indiana: Division of Planning, 1971), pgs. 5-6.
28. Indiana State Highway Commission, Division of Design, Design Manual (Indianapolis, Indiana: Division of Design; January, 1971), p. 7-000.02x.
29. U.S. Department of Commerce, Bureau of Public Roads, Instructional Memorandum 21-1-67 (Subject: Interstate Highways - F A.I. Fund Participation in Costs of Additional Stage Construction on Through Traffic Lane Pavement Structures Constructed Prior to October 1963) (Washington, D.C.: Bureau of Public Roads; January 11, 1967), p. 2.
30. Instructional Memorandum 21-1-67, p. 2.
31. U.S. Department of Transportation, Federal Highway Administration, Circular Memorandum 5-9-67 (Subject: 1968 Interstate Cost Estimate and IM21-1-67: Additional Stage Construction on Pavement Structures Constructed or Authorized to be Constructed Prior to October 1963) (Washington, D.C.: Federal Highway Administration; May 1, 1967), p. 1.
32. Circular Memorandum 5-9-67, p. 2.
33. Circular Memorandum 5-9-67, pgs. 8-9.
34. U.S. Department of Commerce, Bureau of Public Roads, Instructional Memorandum 21-6-66 (Subject: Safety Provisions for Roadside Features and Appurtenances) (Washington, D.C.: Bureau of Public Roads, August 1, 1966).
35. United States Department of Transportation, Federal Highway Administration, National Highway Safety Bureau, Report on The Highway Safety Program Standards (Washington, D.C.: National Highway Safety Bureau; July 1, 1967), pgs. 83-85.
36. Report on The Highway Safety Program Standards, p. 85.
37. American Association of State Highway Officials, Highway Design and Operational Practices Related to Highway Safety (Washington, D.C.: AASHO; February 1967), pgs. 1-3.





38. Indiana State Highway Commission, 1972 Estimate of the Cost of Completing the National System of Interstate and Defense Highways in the State of Indiana (Indianapolis, Indiana: Indiana State Highway Commission; August, 1971).
39. 1972 Estimate of the Cost of Completing the National System of Interstate and Defense Highways in the State of Indiana.
40. U.S. Department of Commerce, Bureau of Public Roads, Instructional Memorandum 40-2-66 (Subject: Interstate highways - bridge widths) (Washington, D.C.: Bureau of Public Roads; November 3, 1966), Figure I.
41. Instructional Memorandum 40-2-66, Figure II.
42. 1972 Interstate Cost Estimate in Indiana.
43. Instructional Memorandum 40-2-66, Figure III.
44. U.S. Department of Transportation, Federal Highway Administration, Instructional Memorandum 40-2-67 (Subject: Bridge Widths - Safety Provisions) (Washington, D.C.: Federal Highway Administration; October 3, 1967), p. 1.
45. Instructional Memorandum 40-2-67, Figure 1.
46. Instructional Memorandum 40-2-67, Figure 2.
47. U.S. Department of Commerce, Bureau of Public Roads, Instructional Memorandum 40-1-67 (Subject: Guidelines for Lateral Clearances and Use of Guardrails at Bridge Piers and Abutments adjacent to High-Speed Traveled Ways) (Washington, D.C.: Bureau of Public Roads; February 2, 1967), Plate 4.
48. Highway Design and Operational Practices Related to Highway Safety, p. 23.
49. Jack E. Leisch, Interchange Design (Chicago: De Leuw, Cather and Company, Consulting Engineers; November, 1962), p. 36.
50. Interchange Design, p. 37.
51. Interchange Design, p. 39.



52. Gilbert T. Satterly, Jr., Spacing of Interchanges and Grade Separations on Urban Freeways (Evanston, Illinois: Northwestern University; June, 1965), p. 126.
53. U.S. Department of Commerce, Bureau of Public Roads, Instructional Manual for Preparation and Submission of the 1961 Estimate of the Cost of Completing the Interstate System (Washington, D.C.: U.S. Government Printing Office, 1960), p. 19.
54. Instructional Manual for Preparation and Submission of the 1961 Estimate of the Cost of Completing the Interstate System, p. 19.
55. Instructional Manual for Preparation and Submission of the 1961 Estimate of the Cost of Completing the Interstate System, p. 19.
56. U.S. Department of Transportation, Federal Highway Administration, Instructional Manual for Preparation and Submission of the 1970 Estimate of the Cost of Completing the Interstate System (Washington, D.C.: U.S. Government Printing Office, 1969), p. 25.
57. Based on Jack E. Leisch, "Determination of Interchange Types on Freeway Facilities: Systems Engineering Approach", Traffic Engineering, Vol. 42, No. 8 (Washington, D.C.: Institute of Traffic Engineers; May, 1972), p. 16.
58. Interchange Design, p. 8.
59. U.S. Department of Commerce, Bureau of Public Roads, Circular Memorandum 9-62 of G. M. Williams (Subject: Interstate Highways Participation Limits and Interchanges) (Washington, D.C.: Bureau of Public Roads September, 1962), p. 1.
60. Circular Memorandum 9-62 of G. M. Williams, Figure 1.
61. Circular Memorandum 9-62 of G. M. Williams, Figure 2.
62. Circular Memorandum 9-62 of G. M. Williams, Figure 3.
63. Circular Memorandum 9-62 of G. M. Williams, Figure 4.
64. Circular Memorandum 9-62 of G. M. Williams, Figure 5.
65. Circular Memorandum 9-62 of G. M. Williams, Figure 6.
66. Circular Memorandum 9-62 of G. M. Williams, Figure 7.
67. Circular Memorandum 9-62 of G. M. Williams, p. 3.



68. Circular Memorandum 9-62 of G. M. Williams, Figure 8.
69. Circular Memorandum 9-62 of G. M. Williams, Figure 9.
70. Circular Memorandum 9-62 of G. M. Williams, Figure 11.
71. Circular Memorandum 9-62 of G. M. Williams, p. 4.
72. Circular Memorandum 9-62 of G. M. Williams, Figures 16-18.
73. Circular Memorandum 9-62 of G. M. Williams, Figures 29-30.
74. Circular Memorandum 9-62 of G. M. Williams, Figures 31-32.
75. U.S. Department of Commerce, Bureau of Public Roads, Instructional Manual for Preparation and Submission of the 1965 Estimate of the Cost of Completing The Interstate System (Washington, D.C.: U.S. Government Printing Office, 1964), p. 17.
76. U.S. Department of Transportation, Federal Highway Administration, Policy and Procedure Memorandum 21-16 (Subject: Highway Safety Improvement Projects) (Washington, D.C.: Federal Highway Administration; March 7, 1969), p. 1.
77. Policy and Procedure Memorandum 21-16, p. 3.
78. Instructional Manual for Preparation and Submission of the 1970 Estimate of the Cost of Completing The Interstate System, p. 22.
79. Policy and Procedure Memorandum 21-16, p. 2.
80. U.S. Department of Transportation, Federal Highway Administration, Instructional Memorandum 21-8-71 (Washington, D.C.: Federal Highway Administration; May 4, 1971), p. 1.
81. Instructional Manual 21-8-71, p. 2.





82. Instructional Manual for Preparation and Submission of the 1961 Estimate of the Cost of Completing the Interstate System, p. 28.
83. U.S. Department of Transportation, Federal Highway Administration, FHWA Notice of June 23, 1971 (Subject: Joint Development to Achieve Broad Scale Planning) (Washington, D.C.: Federal Highway Administration: June 23, 1971), abstract.
84. U.S. Department of Transportation, Federal Highway Administration, Instructional Memorandum 21-2-69 (Washington, D.C.: Federal Highway Administration; January 17, 1969), p. 3.
85. U.S. Department of Commerce, Bureau of Public Roads, Instructional Memorandum 21-5-63 (Subject: Coordination of public interests of highway improvements with those of fish and wildlife resources) (Washington, D.C.: Bureau of Public Roads; June 12, 1963), p. 2.
86. United States Code, Title 23 - Highways, Section 138 (Washington, D.C.: U.S. Government Printing Office, 1970), p. 6020.
87. U.S. Statutes at Large, PL91-190 (National Environmental Policy Act of 1969), Section 102(2)A (Washington, D.C.: U.S. Government Printing Office).
88. U.S. States at Large, PL 91-190, Section 102(2)C.
89. United States Codes, Title 23 - Highways, Section 109 g-j (Washington, D.C.: U.S. Government Printinf Office), p. 5998.
90. U.S. Department of Transportation, Federal Highway Administration, Process Guidelines for Consideration of Environmental Effects (Washington, D.C.: Federal Highway Administration), p. 5. [Rough draft for new policy and procedure memorandum in the 90 series].
91. Policy and Procedure Memorandum 90-1, p. 3.
92. Policy and Procedure Memorandum 90-1, p. C-1.
93. Refer to Policy and Procedure Memorandum 90-1, p. F-1



94. Policy and Procedure Memorandum 90-1, p. D-1.
95. Policy and Procedure Memorandum 90-1, p. F-1.
96. Indiana State Highway Commission, Division of Design, Section of Roadside Development, Environmental Impact Statements (Indianapolis: Indiana State Highway Commission; March 10, 1972), p. 1-2.
97. Policy and Procedure Memorandum 90-1, p. E-1.
98. Policy and Procedure Memorandum 90-1, p. E-2.
99. U.S. Department of Commerce, Bureau of Public Roads, Policy and Procedure Memorandum 21-17 (Subject: Landscaping and Scenic Enhancements) (Washington, D.C.: Bureau of Public Roads; February 18, 1966), p. 3.
100. Policy and Procedure Memorandum 21-17, p. 3.
101. Laws, pgs. 262-263.
102. U.S. Department of Transportation, Federal Highway Administration, Policy and Procedure Memorandum 80-9 Subject: Acquisition Procedures for the Control of Outdoor Advertising Signs and Junkyards and for Landscaping and Scenic Enhancement) (Washington, D.C.: Federal Highway Administration; March 31, 1967), p. 5.
103. U.S. Department of Transportation, Federal Highway Administration, Highway Environment Reference Book (Washington, D.C.: Federal Highway Administration; November, 1970), p. 43.
104. United States Code, Title 23 - Highways, Section 136, p. 6018.
105. Policy and Procedure Memorandum 80-9, p. 7.
106. "Acts of 1945", Laws of the State of Indiana, 84th Session (Indianapolis: The Bookwalter Company, 1945), Ch. 245, Sec. 7, p. 1113; and "Acts of 1955", Laws of the State of Indiana, 89th Session (Indianapolis: The Bookwalter Company, 1955), Ch. 197, Sec. 1, p. 516.





107. Highway Environment Reference Book, p. 15.
108. U.S. Department of Transportation, Federal Highway Administration, Instructional Memorandum 20-1-69 (Subject: Interim Criteria Promulgated under Paragraph 10e, PPM20-8, Public Hearings and Location Approval; Relating to Right-of-Way Acquisition) (Washington, D.C.: Federal Highway Administration; June 11, 1969), p. 1.
109. Instructional Memorandum 20-1-69, p. 1.
110. U.S. Department of Transportation, Federal Highway Administration, Instructional Memorandum 80-1-71 (Subject: Relocation Assistance and Payments --- Interim Operating Procedures) (Washington, D.C.: Federal Highway Administration; April 30, 1971), p. 21.
111. U.S. Statutes at Large, PL91-646 (Uniform Relocation Assistance and Real Property Acquisition Policies Act of 1970), Section 205(C) (Washington, D.C.: U.S. Government Printing Office).
112. U.S. Department of Transportation, Federal Highway Administration, Instructional Memorandum 80-1-68 (Subject: Relocation Assistance and Payments --- Interim Operating Procedures) (Washington, D.C.: Federal Highway Administration; September 5, 1968), p. 3.
113. Instructional Memorandum 80-1-71, p. 19.
114. Instructional Memorandum 80-1-71, pgs. 25-26.
115. Indiana State Highway Commission, Division of Land Acquisition, Section of Relocation, Indiana Relocation Policy and Procedure Manual (Indianapolis: Indiana State Highway Commission, 1971), pgs. 7-9.
116. Instructional Memorandum 80-1-71, p. 26.
117. "Acts of 1971", Laws of the State of Indiana, PL 97-97 (Indiana Relocation Act of 1971), Sec. 5 (Indianapolis: The Bookwalter Company, 1971), p. 450.



118. "Acts of 1967", Laws of the State of Indiana, Session (Indianapolis: The Bookwalter Company, 1967), Ch. 316, Sec. 13, p. 1226.
119. Instructional Memorandum 80-1-71, p. 3.
120. Instructional Memorandum 80-1-71, p. 4.







COVER DESIGN BY ALDO GIORGINI